RS Series
Screw Compressor Central Chiller

Part Number: A0551794
Bulletin Number: AE3-635.2
Effective: 10/1/07

Write Down Your Serial Numbers Here For Future Reference:

_____ _____

_____ _____

_____ _____

We are committed to a continuing program of product improvement.
Specifications, appearance, and dimensions described in this manual are subject to change without notice.

DCN No. _____
© Copyright 2008
All rights reserved.

Shipping Information

Unpacking and Inspection

You should inspect your Screw Compressor Central Chiller for possible shipping damage.

Thoroughly check the equipment for any damage that might have occurred in transit, such as broken or loose wiring and components, loose hardware and mounting screws, etc.

In the Event of Shipping Damage

According to the contract terms and conditions of the Carrier, the responsibility of the Shipper ends at the time and place of shipment.

Notify the transportation company's local agent if you discover damage.

Hold the damaged goods and packing material for the examining agent's inspection. **Do not return any goods before the transportation company's inspection and authorization.**

File a claim with the transportation company. Substantiate the claim by referring to the agent's report. A certified copy of our invoice is available upon request. The original Bill of Lading is attached to our original invoice. If the shipment was prepaid, write us for a receipted transportation bill.

Advise customer service regarding your wish for assistance and to obtain an RMA (return material authorization) number.

If the Shipment is Not Complete

Check the packing list as back-ordered items are noted on it. You should have:

- ☑ Screw Compressor Central Chiller
- ☑ Bill of lading
- ☑ Packing list
- ☑ Operating and Installation packet
- ☑ Electrical schematic and panel layout drawings
- ☑ Component instruction manuals

Re-inspect the container and packing material to see if you missed any smaller items during unpacking.

If the Shipment is Not Correct

If the shipment is not what you ordered, **contact the parts and service department immediately at (847) 273-7700**. Have the order number and item number available. *Hold the items until you receive shipping instructions*.

Returns

Do not return any damaged or incorrect items until you receive shipping instructions from the shipping department.

Table of Contents

CHAPTER 1: SAFETY VI

1-1 How to Use This Manual vi
Safety Symbols Used in this Manual vi
1-2 Warnings and Precautions vii
1-3 Responsibility viii
General Responsibility viii
Operator Responsibility ix
Maintenance Responsibility x
Reporting a Safety Defect x

CHAPTER 2: FUNCTIONAL DESCRIPTION 11

2-1 Models Covered in This Manual 11
2-2 General Description 11
2-3 Standard Features 11
Mechanical Features 11
Electrical Features 12
Controller Features 12
Standard Features on Remote Condensers 12
2-4 Options 13
2-5 Safety Devices and Interlocks 13

CHAPTER 3: INSTALLATION 15

3-1 Uncrating the Equipment 15
3-2 Rigging and Placing the Chiller 15
3-3 Making Electrical Connections 16
3-4 Setup Procedures 17
Piping Considerations 17
Making Process Water Connections 18
Making Tank Piping Connections 19
Water Connection Sizing Considerations 21
Galvanic Corrosion Considerations 21
Water Treatment Considerations 21
Making Water-Cooled Condenser Connections 21
Installing the Remote Air-Cooled Central Chiller Condensers 23
Checking Motor Direction 28
Changing fan rotation direction 28
3-5 Initial Start-up 28
Pre-Startup Checks 28
Determining Chilled Water Flow Rate 32

CHAPTER 4: OPERATION 33

4-1 Start-up 33
Water & Remote Air-Cooled Central Chiller Startup 33
4-2 Controller Description 34

Identifying Control Panel Indicator Lights and Switches for the Standard and Advanced Controllers *34*
4-3 Controller Operation (Standard Controller) 36
Using the Standard Touchscreen Interface *36*
Main Menu Screen *37*
Compressor Status Screen *37*
Process and Recirculation Pump Status Screens *39*
Active Alarm List and Alarm History Screens *40*
Configuration Menu Screen *41*
Viewing and Setting System Temperatures *45*
Hourmeters Screen *46*
4-4 Controller Operation (Advanced Controller) 48
Using the Advanced Touchscreen Interface *48*
Accessing the Main Menu Screen *49*
Viewing Compressor Status *51*
Viewing Chiller Pump Status *53*
Viewing Active Alarms and Alarm History Screens *54*
Configuration Menu Screen *56*
Viewing and Setting System Temperatures *58*
Viewing Compressor Run Times *60*
Viewing Pump Run Times *62*
4-5 Operation Procedures 63
4-6 Shutdown 63

CHAPTER 5: MAINTENANCE 64

5-1 Maintenance Schedule 64
5-2 Preventative Maintenance 65
Lubrication *65*
Condenser Maintenance *65*
5-3 Corrective Maintenance 66
Evaporator Maintenance *66*
Miscellaneous Maintenance *66*

CHAPTER 6: TROUBLESHOOTING 67

6-1 Introduction 67

CHAPTER 7: APPENDIX 70

7-1 Optional Components 70
7-2 Technical Specifications 70
Model Number Nomeclature *70*
Typical Two-Circuit 60-195 Ton Remote Water Cooled Chiller Specifications *71*
Typical Two-Circuit 60-195 Ton Remote Air Cooled Chiller Specifications *72*
RSR Series Remote Condenser Models *73*
7-3 Drawings & Diagrams 73
7-4 Spare Parts List 74
7-5 Returned Material Policy 75
Credit Returns *75*
Warranty Returns *75*
7-6 Safety Tag Information 75
Central Chiller Safety Tags *75*

7-7 Central Chiller Identification (Serial Number) Tag 76
7-8 Technical Assistance 77
Parts Department 77
Service Department 77
Sales Department 77
Contract Department 77

Chapter 1: Safety

1-1 How to Use This Manual

Use this manual as a guide and reference for installing, operating, and maintaining your screw compressor central chiller. The purpose is to assist you in applying efficient, proven techniques that enhance equipment productivity.

This manual covers only light corrective maintenance. No other maintenance should be undertaken without first contacting a service engineer.

The Functional Description section outlines models covered, standard features, and safety features. Additional sections within the manual provide instructions for installation, pre-operational procedures, operation, preventive maintenance, and corrective maintenance.

The Installation chapter includes required data for receiving, unpacking, inspecting, and setup of the screw compressor central chiller. We can also provide the assistance of a factory-trained technician to help train your operator(s) for a nominal charge. This section includes instructions, checks, and adjustments that should be followed before commencing with operation of the Central Chiller. These instructions are intended to supplement standard shop procedures performed at shift, daily, and weekly intervals.

The Operation chapter includes a description of electrical and mechanical controls, in addition to information for operating the Central Chiller safely and efficiently.

The Maintenance chapter is intended to serve as a source of detailed assembly and disassembly instructions for those areas of the equipment requiring service. Preventive maintenance sections are included to ensure that your Central Chiller provides excellent, long service.

The Troubleshooting chapter serves as a guide for identification of most common problems. Potential problems are listed, along with possible causes and related solutions.

The Appendix contains technical specifications, drawings, schematics, parts lists, and available options. A spare parts list with part numbers specific to your machine is provided with your shipping paperwork package. Refer to this section for a listing of spare parts for purchase. Have your serial number and model number ready when ordering.

Safety Symbols Used in this Manual

The following safety alert symbols are used to alert you to potential personal injury hazards. Obey all safety messages that follow these symbols to avoid possible injury or death.

DANGER! ***DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.***

WARNING! ***WARNING indicates a potentially hazardous situation or practice that, if not avoided, could result in death or serious injury.***

Caution! ***CAUTION indicates a potentially hazardous situation or practice that, if not avoided, may result in minor or moderate injury or in property damage.***

1-2 Warnings and Precautions

Our equipment is designed to provide safe and reliable operation when installed and operated within design specifications, following national and local safety codes. This may include, but is not limited to OSHA, NEC, CSA, SPI, and any other local, national and international regulations.

To avoid possible personal injury or equipment damage when installing, operating, or maintaining this equipment, use good judgment and follow these safe practices:

- ☑ **Read and follow these operation and installation instructions when installing, operating, and maintaining this equipment. If these instructions become damaged or unreadable, additional copies are available from the manufacturer.**
- ☑ Follow all **SAFETY CODES**.
- ☑ Wear **SAFETY GLASSES** and **WORK GLOVES**.
- ☑ Work only with approved tools and devices.
- ☑ Disconnect and/or lock out power before servicing or maintaining the equipment.
- ☑ Use care when **LOADING**, **UNLOADING**, **RIGGING**, or **MOVING** this equipment.
- ☑ Operate this equipment within design specifications.
- ☑ **OPEN**, **TAG**, and **LOCK ALL DISCONNECTS** before working on equipment. You should remove the fuses and carry them with you.
- ☑ Make sure the equipment and components are properly **GROUNDED** before you switch on power.
- ☑ When welding or brazing in or around this equipment, make sure **VENTILATION** is **ADEQUATE**. **PROTECT** adjacent materials from flame or sparks by shielding with sheet metal. An approved **FIRE EXTINGUISHER** should be close at hand and ready for use if needed.
- ☑ Do not restore power until you remove all tools, test equipment, etc., and the equipment and related components are fully reassembled.
- ☑ Only **PROPERLY TRAINED** personnel familiar with the information in this manual should work on this equipment.

We have long recognized the importance of safety and have designed and manufactured our equipment with operator safety as a prime consideration. We expect you, as a user, to abide by the foregoing recommendations in order to make operator safety a reality.

1-3 Responsibility

These machines are constructed for maximum operator safety when used under standard operating conditions and when recommended instructions are followed in the maintenance and operation of the machine.

All personnel engaged in the use of the machine should become familiar with its operation as described in this manual.

Proper operation of the machine promotes safety for the operator and all workers in its vicinity.

Each individual must take responsibility for observing the prescribed safety rules as outlined. All warning and danger signs must be observed and obeyed. All actual or potential danger areas must be reported to your immediate supervisor.

General Responsibility

No mater who you are, safety is important. Owners, operators and maintenance personnel must realize that every day, safety is a vital part of their jobs.

If your main concern is loss of productivity, remember that production is always affected in a negative way following an accident. The following are some of the ways that accidents can affect your production:

- Loss of a skilled operator (temporarily or permanently)
- Breakdown of shop morale
- Costly damage to equipment
- Downtime

An effective safety program is responsible and economically sound.

Organize a safety committee or group, and hold regular meetings. Promote this group from the management level. Through this group, the safety program can be continually reviewed, maintained, and improved. Keep minutes or a record of the meetings.

Hold daily equipment inspections in addition to regular maintenance checks. You will keep your equipment safe for production and exhibit your commitment to safety.

Please read and use this manual as a guide to equipment safety. This manual contains safety warnings throughout, specific to each function and point of operation.

Operator Responsibility

The operator's responsibility does not end with efficient production. The operator usually has the most daily contact with the equipment and intimately knows its capabilities and limitations.

Plant and personnel safety is sometimes forgotten in the desire to meet incentive rates, or through a casual attitude toward machinery formed over a period of months or years. Your employer probably has established a set of safety rules in your workplace. Those rules, this manual, or any other safety information will not keep you from being injured while operating your equipment.

Learn and always use safe operation procedures. Cooperate with co-workers to promote safe practices. Immediately report any potentially dangerous situation to your supervisor or appropriate person.

REMEMBER:

- **NEVER** place your hands or any part of your body in any dangerous location.
- **NEVER** operate, service, or adjust the chiller without appropriate training and first reading and understanding this manual.
- Before you start the chiller check the following:
    - Remove all tools from the chiller;
    - Be sure no objects (tools, nuts, bolts, clamps, bars) are laying in the chillers operating area;
- If your chiller has been inoperative or unattended, check all settings before starting the unit.
- At the beginning of your shift and after breaks, verify that the controls and other auxiliary equipment are functioning properly.
- Keep all safety guards in place and in good repair. **NEVER** attempt to bypass, modify, or remove safety guards. Such alteration is not only unsafe, but will void the warranty on your equipment.
- When changing control settings to perform a different mode of operation, be sure selector switches are correctly positioned. Locking selector switches should only be adjusted by authorized personnel and the keys removed after setting.
- Report the following occurrences **IMMEDIATELY:**
    - unsafe operation or condition
    - unusual chiller action
    - leakage
    - improper maintenance
    - **NEVER** stand or sit where you could slip or stumble into the chiller while working on it.
- **DO NOT** wear loose clothing or jewelry, which can be caught while working on a chiller. In addition, cover or tie back long hair.

- Clean the chiller and surrounding area **DAILY**, and inspect the machine for loose, missing or broken parts.
- Shut off power to the chiller when it is not in use. Turn the switch to the **OFF** position, or unplug it from the power source.

Maintenance Responsibility

Proper maintenance is essential to safety. If you are a maintenance worker, you must make safety a priority to effectively repair and maintain equipment.

Before removing, adjusting, or replacing parts on a machine, remember to turn off all electric supplies and all accessory equipment at the machine, and disconnect and lockout electrical power. Attach warning tags to the disconnect switch.

When you need to perform maintenance or repair work on equipment above floor level, use a solid platform or a hydraulic elevator. If there is a permanently installed catwalk on your equipment, use it. The work platform should have secure footing and a place for tools and parts. **DO NOT** climb on equipment, machines, or work from ladders.

If you need to repair a large component, use appropriate handling equipment. Before you use handling equipment (portable "A" frames, electric boom trucks, fork trucks, overhead cranes) be sure the load does not exceed the capacity of the handling equipment or cause it to become unstable.

Carefully test the condition of lifting cables, chains, ropes, slings, and hooks before using them to lift a load.

Be sure that all non-current carrying parts are correctly connected to earth ground with an electrical conductor that complies with current codes. Install in accordance with national and local codes.

When you have completed the repair or maintenance procedure, check your work and remove your tools, rigging, and handling equipment.

Do not restore power to the equipment until all persons are clear of the area. **DO NOT** start and run the machine until you are sure all parts are functioning correctly.

BEFORE you turn the machine over to the operator for production, verify all equipment enclosure panels, guards and safety devices are in place and functioning properly.

Reporting a Safety Defect

If you believe that your equipment has a defect that could cause injury, you should immediately discontinue its use and inform the manufacturer.

The principle factors that can result in injury are failure to follow proper operating procedures (i.e. lockout/tagout), or failure to maintain a clean and safe working environment.

Chapter 2: Functional Description

2-1 Models Covered in This Manual

This manual provides operation, installation, and maintenance instructions for Screw Compressor Central Chillers. Model numbers are listed on the serial tag. Make sure you know the model and serial number of your equipment before contacting the manufacturer for parts or service.

Our screw compressor central chillers are designed to generate cooled water at carefully controlled temperatures for use in plastic processing systems. Screw Compressor Central chilling systems are sized to meet the specific requirements stated by the Customer at the time of purchase.

2-2 General Description

Screw compressor central water chilling stations are available in water-cooled and remote air-cooled designs. They differ only in the condensing media used. These units are configured with two independent circuits using multiple compressors for each circuit. This manual lists information specific to these units.

Screw Compressor central chilling stations may be configured with stainless steel pump tanks for use as reservoirs for chilled water processes. These dual-well models hold hot and cold water before and after it is pumped through the chiller. Tanks have recirculation pump(s) to send return water to the chiller and process pump(s) to pump cooled water directly to process. Standby pumps may be utilized to distribute pump service or to allow uninterrupted chiller operation during pump maintenance.

Properly installed, operated, and maintained Screw Compressor Central chilling stations provide many years of reliable operation. **To get the most satisfaction from your new chiller, read and follow the instructions in this manual.**

2-3 Standard Features

Mechanical Features

- Two independent refrigeration circuits
- High-efficiency screw compressors
- Stainless steel brazed plate (60 & 75) Shell & Tube (90-195) evaporators
- Cleanable shell and tube condensers (water-cooled models)
- High and low refrigerant pressure safeties
- Evaporator water piping manifold (Condenser manifold optional)
- R-134a refrigerant
- 1 year warranty on parts and labor

Electrical Features

- Electronic expansion valve
- 2 remote single circuit condensers with variable speed lead fans and fan cycling (air-cooled models)
- NEMA 12 electrical enclosure
- Touch-safe branch circuit fusing
- Liquid line solenoid and shut-off valves
- Chilled water flow switches

Controller Features

- Allen Bradley Micrologix 1500 PLC control with PanelView 300 Micro monochrome/key pad interface
- Digital low temperature freezestat
- 3 year warranty on controller

Standard Features on Remote Condensers

- Direct-drive 3-phase fan motors with ball bearings and internal overload protection
- Electronic variable-speed control of lead fan and fan cycling for constant condenser head pressure control
- Fans are 30” (76 cm) in diameter and have PVC-coated steel fan guards; 1½ hp (1.12 kW) variable-speed fans are 26” (66 cm) in diameter
- Internal baffles between fan cells
- UL listed in the United States and Canada
- Patented floating tube coil to eliminate tube sheet leaks
- Copper tube condenser coils have corrugated aluminum fins
- Weather-proof control panel with factory-mounted door interrupt switch
- High-efficiency condenser coil, designed for optimum performance
- Aluminum housing provides corrosion protection for outdoor applications

2-4 Options

Options marked with "*" indicate options that can be factory installed or retrofitted in the field.

- Advanced control package including: AB SLC 5/04 PLC with PanelView 1000 color touch screen, control of up to nine additional chillers, cooling tower system, water treatment system, and DH+ communication capabilities
- General Fault audible/visual alarm with elevated light stack
- Non-fused rotary thru-the-door disconnect switches
- Electrical operation available in 208, 460, and 575 volts, 60 Hz; 200, 380, and 415 volts, 50 Hz
- UL/$_C$UL-listed electrical subpanel
- Water cooled condenser manifold
- Onsite startup

2-5 Safety Devices and Interlocks

This section includes information on safety devices and procedures that are inherent to the Chiller. This manual is not intended to supersede or alter safety standards established by the user of this equipment. Instead, the material contained in this section is recommended to supplement these procedures in order to provide a safer working environment.

At the completion of this section, the operator and maintenance personnel will be able to do the following:

- Identify and locate specific safety devices.
- Understand the proper use of the safety devices provided.
- Describe the function of the safety device.

Safety Circuit Standards

Safety circuits used in industrial systems protect the operator and maintenance personnel from dangerous energy. They also provide a means of locking out or isolating the energy for servicing equipment.

Various agencies have contributed to the establishment of safety standards that apply to the design and manufacture of automated equipment. The Occupational Safety and Health Administration (OSHA) and the Joint Industrial council (JIC) are just a few of the organizations that have joined with the plastics industry to develop safety standards.

Every effort has been made to incorporate these standards into the design of the chiller; however, it is the responsibility of the personnel operating and maintaining the equipment to familiarize themselves with the safety procedures and the proper use of any safety devices.

Fail Safe Operation

If a safety device or circuit should fail, the design must be such that the failure causes a "Safe" condition. As an example, a safety switch must be a normally open switch. The switch must be held closed with the device it is to protect. If the switch fails, it will go to the open condition, tripping out the safety circuit.

At no time should the safety device fail and allow the operation to continue. For example, if a safety switch is guarding a motor, and the safety switch fails, the motor should not be able to run.

Safety Device Lock-Outs

Some safety devices disconnect electrical energy from a circuit. The safety devices that are used on these chillers are primarily concerned with electrical power disconnection and the disabling of moving parts that may need to be accessed during the normal operation of the machine.

Some of the safety devices utilize a manual activator. This is the method of initiating the safety lock out. This may be in the form of a plug, lever or a handle. Within this lockable handle, there may be a location for a padlock. Personnel servicing the equipment should place a padlock in the lockout handle.

In addition to the safety devices listed above, these chillers are equipped with a line cord plug. This allows the operator or maintenance personnel to unplug the chiller from its power source and tag it out. The plug can then be tagged with any number of approved electrical lockout tags available at most electrical supply stores.

WARNING! ***Always disconnect and lockout all electrical power and pneumatic (i.e. compressed air) sources prior to servicing or cleaning the chiller. Failure to do so may result in serious injury. No one but the person who installed the lockout may remove it.***

Chapter 3: Installation

3-1 Uncrating the Equipment

WARNING! ***Due to the size and weight of the Screw Compressor Chiller, the manufacturer recommends using bonded professional millwrights to unload and move the chiller.***

1. Rig the chiller from the frame only, using spreader bars to prevent load transfer to any chiller components.
2. Rig the frame from at least four points and balance the load before lifting to clear the skid.
3. Use a forklift of adequate size when lifting the chiller by the fork pockets.
4. Insert the forks all the way into the pockets and be sure to balance the load before lifting the chiller to clear the skid. Lift only as high as necessary.
5. Use a pry bar to free the skid if necessary.
6. Lower slowly.

Caution! ***Due to the weight of these units, use extrme caution when moving and placing Screw Compressor Central Chilling Stations.***

3-2 Rigging and Placing the Chiller

As with all equipment installations, follow all applicable codes and regulations.

1. Locate close to the process to reduce piping expense.
2. Locate adjacent to drain and city water sources.
3. Consult a structural engineer to assure that the floor, mounting pad or structural steel support is of adequate strength.
4. Allow for required service clearances necessary for condenser maintenance and easy access to all components. See page **??** in the Appendix for specific information.

3-3 Making Electrical Connections

Screw Compressor Central Chilling systems are designed for three-phase voltage operation. Refer to the unit nameplate for proper voltage and amperage requirements.

Note: Make sure you provide a correctly sized and protected supply of electrical power to the unit.

Refer to National Electric Code (NEC) Article 430-24 through 430-26 for proper feeder conductor and supply disconnect sizing.

Maintain a safe ground and disconnect the power supply before servicing the unit. A qualified electrician should make electrical connections, and disconnect and lock out electricity using OSHA 29 CFR 1910.147 standards when you need to service the unit.

Check serial tag voltage and amperage requirements and make sure your electrical service conforms *before* making any electrical connections. Total running amps for the Screw Compressor Central Chilling systems are listed on the nameplate. Customer connections can be run to the supply terminals from either side of the unit.

WARNING! ***Make sure that all three phases are wired correctly. If not wired properly, the compressor will run* backwards *and cause severe damage to the compressor. Again, check the unit nameplate for correct voltage and amperage. Compressors must be wired in sequence (ABC). If not wired properly, the unit can be damaged if run backwards.***

DANGER! ***Improper electrical connections can damage the unit and cause serious operator injury or death! Compressor damage will occur if compressors are run backwards.***

Bring properly sized power leads and ground from a fused disconnect (installed by your electrician) to the unit. Provide external overcurrent protection to the unit, using circuit breakers or fuses. If you use fuses, make sure that they are dual-element time-delay fuses, sized according to your electrical code. Make sure that **all** electrical connections are ***tight***.

Note: The following MUST be followed when making electrical connections for your central chiller:

1. Electrical connections must comply with all applicable electrical codes.
2. The chiller must be grounded in accordance with NEC Article 250.
3. Voltage must be within plus or minus ten percent (±10%) of the nameplate rating with 2% maximum imbalance between legs.
4. Make sure your installer provides external protection.

Caution! ***Check Compressor Rotation Before Starting Unit!***
Connect a phase monitor and phase incoming power ABC.

Check the electrical wiring schematic provided in your Customer Information packet for additional information.

Note:

- *Never switch contactor leads or motor leads for reversing rotation.*
- *Do not use contactor or motor leads for phase matching.*
- ***Compressor damage will occur if the compressor is run in reverse. The compressor motor protector checks for correct phasing and will not allow it to start in reverse.***
- *If you discover that phasing is reversed, correct it by switching any two **main** power leads* **into the disconnect switch or distribution block** *on the unit.*

Check your work and proceed to the next section.

3-4 Setup Procedures

This section provides the procedures necessary for configuring your Screw Compressor Central Chiller.

Configuration of your chiller includes making process water connections, tank piping connections, water-cooled condenser connections, and connecting the remote air-cooled condenser. We recommend that you carry out these procedures in the order given here.

Note: Before carrying out these procedures, install all equipment as described in this section.

Piping Considerations

Piping systems vary with process application and pump tank configuration. Typical system configuration drawings are provided in this manual; the details may or may not apply to your application. Piping systems must be designed by a person knowledgeable in piping system design and configuration. Our Contracting Department can design and install a piping system tailored to your process.

- All piping returning to the pump tank **must** be equipped with an inverted trap with a vacuum breaker at the high point of the system to prevent mains from siphoning into the pump tank.
- Run mains full size in order to reduce pressure drop in the system and provide maximum pressures at the ends of the mains.

Making Process Water Connections

All Models

All central chilling stations have two chilled water connections per unit, and on water-cooled models, one more set of water connections for condenser water:

The chilled water manifold allows one-point connections of Chilled Water piping. The Sch. 40 steel piping includes butterfly valves at each evaporator for flow balancing and circuit isolation; optional pressure gauges can be installed.

To Process

The chilled water supply outlet should be piped to the cold side of the pump tank.

From Process

The chilled water return for water returning back to the chiller from the process to be cooled and recirculated from the hot side of the pump tank.

Control Probe

This central chilling station is equipped with two control probes which sense temperatures. One probe measures the temperature of the hot well and the other does the same for the cold well of the reservoir. These temperatures are used by the PLC controller to sequence the compressors, based on load.

Making Tank Piping Connections

If you have purchased the Screw Compressor central chilling station with the **optional** integral pump tank, please proceed with this section.

Note: Thermocouplings for chillers must be installed on both the hot and cold sides of the tank.

Freezestat Control

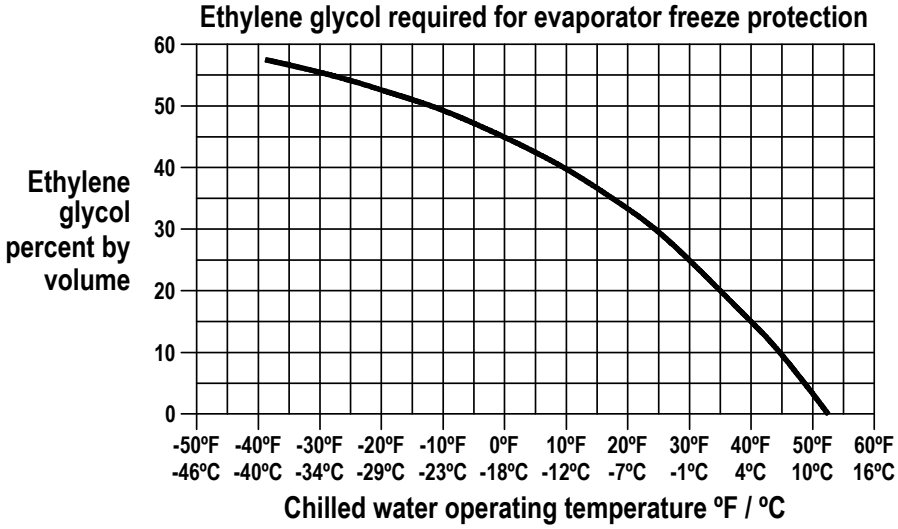
The unit can be equipped with a freezestat control which shuts down the compressor if the chilled water temperature approaches the freezing point. The chilled water pump on the system will continue to run. It is factory-set at 40°F (4ºC) or 10°F (6ºC) below the rated capacity operating temperature of 50°F (10ºC).

If you want lower chilled water temperatures (minimum of 30°F (-1ºC), you'll need to mix process water with industrial- (not automotive) grade ethylene or propylene glycol with rust inhibitor to provide protection down to 20°F (12ºC) below the operating temperature you want. Figure 1 below shows the proper mixtures needed to provide protection to 20°F (12ºC) below the operating temperature you want. You can then reset the freezestat cutout temperature to a temperature 10°F (6ºC) below the operating temperature you selected.

Caution! ***Make sure all freezestat adjustments are performed by a qualified refrigeration service technician.***

The manufacturers product warranty does not cover system freeze-up!

Figure 1: Freezing Protection Curve



Example: Desired leaving temperature = 35°F (1.7ºC),
Glycol % by volume = 35%
This will provide protection to 15°F (-9.4ºC)

Return (From Process)

Bring the chilled water returning from the process to the pump tank warm **(From Process)** side. This line is sized according to the flow rate from the process to the pump tank. See Page 16 for more information on piping considerations.

Caution! ***Do* not *use the Screw Compressor Central Chiller to support piping.***

Makeup

Connect a city water source to maintain water level in the pump tank. See page 21 for water treatment considerations.

Note: If glycol is to be added to the system, DO NOT DO THIS!

Overflow

Connect the **OVERFLOW** outlet to an approved, trapped drain to permit excess water in the pump tank to overflow to the drain. The overflow line is sized according to the size of the pump tank.

Flow Switch

This central chiller station is equipped with a flow switch which shuts down the chiller if the evaporator water flow falls below a safe operating gallons-per-minute (liters-per-minute) flow rate.

Control Nozzle

All central chilling station evaporators have two control nozzles. The flow switch, freezestat, and flush port are located in the control nozzle. Pressure gages are mounted in the control nozzles to aid in achieving proper flow through the evaporator and balancing flows.

Pressure drop between evaporator entering water pressure and evaporator leaving water pressure can be converted to gallons per minute using the pressure drop chart below.

Model Number	Water Side Pressure Drop			
	Condenser (each)		Evaporator (each)	
	Flow (gpm)	PD (psi)	Flow (gpm)	PD (psi)
RSW/R60	91	4.0	72	5.3
RSW/R75	102	4.7	90	4.5
RSW/R90	117	4.4	107	5.6
RSW/R100	150	5.5	123	3.9
RSW/R115	166	4.3	140	3.0
RSW/R145	196	4.1	175	4.8
RSW/R165	219	4.1	200	4.6
RSW/R195	278	4.7	232	6.0

To Drain

Connect to a 1½" line (approx. 63 mm) leading to an approved, trapped drain. You can drain the pump tank if necessary.

Note:If glycol is added to the system, DO NOT DO THIS!

Water Connection Sizing Considerations

Note:

- ***Run all external chilled water connections with adequate size to the process.***
- ***Provide the largest possible openings and passages for the flow of chilled water through platens, dies, molds, or other pieces of equipment.***
- ***Minimum external pressure drop is*** critical ***for proper operation.***

Galvanic Corrosion Considerations

Water circuit piping components are primarily ferrous (iron) and react electro-chemically with non-ferrous metallic materials such as copper. Some water has dissolved minerals that will greatly accelerate the reaction between dissimilar metals.

Use PVC or ferrous piping to minimize galvanic action. If piping must be copper, use dielectric unions at the chiller.

Water Treatment Considerations

Water treatment is important in any piping system. In some locations, raw water may be used in the system without problem; in other locations, it will result in large deposits of scale and corrosion.

We offer a complete line of water treatment equipment. Contact your sales representative for water testing and treatment options.

Making Water-Cooled Condenser Connections

Screw compressor water-cooled chilling stations use city or tower water as a cooling medium. All external condenser supply, discharge piping and connections should be of adequate size. Water regulating valves are not required on the Screw Compressor Chiller if the tower water does not fall below 65°F (18ºC). Water flow must be adjusted based upon the pressure drop in the following table on the next page.

Two connections are made to each unit:

Condenser Water In

The optional condenser water manifold allows one-point connection of **TO TOWER** (drain) and **FROM TOWER** (city water) piping. Sch. 40 steel include butterfly valves for each condenser.

The city or tower water supply inlet is located at the side or rear of the chiller.

- Water pressure ≥25 psi (≥172.4 kPa/≥1.72 bars)
- Water temperature ≤85°F (≤29ºC)

Condenser Water Out

The return outlet, located at the chiller side or rear is connected to a cooling tower inlet, a sewer or other approved discharge receiver.

- A water regulating valve is an **optional** feature in the condenser water out line.
- Adjust the butterfly valve for the pressure drop that corresponds to the model number of the chiller (Shown in the table below). Pressure drop is equal to supply pressure minus return pressure. (If a water regulating valve has been supplied, **adjustment is not required**.)

Model Number	Water Side Pressure Drop			
	Condenser (each)		Evaporator (each)	
	Flow (gpm)	PD (psi)	Flow (gpm)	PD (psi)
RSW/R60	91	4.0	72	5.3
RSW/R75	102	4.7	90	4.5
RSW/R90	117	4.4	107	5.6
RSW/R100	150	5.5	123	3.9
RSW/R115	166	4.3	140	3.0
RSW/R145	196	4.1	175	4.8
RSW/R165	219	4.1	200	4.6
RSW/R195	278	4.7	232	6.0

High Pressure Cutout

This unit is equipped with an electro-mechanical safety feature which opens the control circuit if the system condensing pressure exceeds a safe level. The table below lists the manufacturer settings for this safety feature:

High pressure cutout setting			
Model	psi	kPa	bars
Water and Remote air-cooled chilling stations	290 psi	2,000 kPa	20 bars

Note: The high pressure cutout is a manual reset control, so you should reset it once.

If the problem persists, call a refrigeration service technician to analyze the problem and to reset the control.

Low Pressure Cutout

This encapsulated switch safety feature prevents the compressor suction pressure from dropping below a pre-set point. It is factory set to open the control circuit when pressure drops below a safe level of 15 psi. The chiller will restart when the suction pressure reaches 30 psi (206.9 kPa/2.1 bars). The table below lists the settings at which the control circuit will be open or reset.

Model	Opens control circuit @			Resets control circuit @		
	psi	kPa	bars	psi	kPa	bars
Water-cooled and remote air-cooled chilling stations	15 psi	103.4 kPa	1.0 bars	30 psi	206.9 kPa	2.1 bars

Installing the Remote Air-Cooled Central Chiller Condensers

Remote air-cooled condensers use the surrounding air to cool the refrigerant from the compressor and release the process heat absorbed from the chilled water into the atmosphere. All models have variable speed fans and low ambient controls to allow proper operation down to -20°F (-29°C) outdoor air temperature.

Remote air-cooled central chillers are shipped with a nitrogen holding charge and a full charge of oil (excluding the amount needed for field piping). The remote air condenser is shipped with a dry air charge. Verify that the holding charge has not been lost prior to installation. If there is no pressure, leak test the unit and repair before installing the interconnecting refrigerant piping.

Read this entire section before installation.

Select a site to install the remote air-cooled condensers where there is:

1. As short and direct routing of the interconnecting lines as practical.
2. Free passage of air for condensing.
3. Adequate structural support.
4. Protection from strong winds and drifting snow.
5. Adequate ventilation for removal of heated air from the area.
6. No steam, hot air, or fume exhausts that can be drawn into the condenser coils.
7. Adequate space to service unit. See page **XX** for clearance requirements.

Note: Piping should be type "L" or type "K" refrigerant grade copper tubing only. Proper sizing and installation has a significant effect on system performance, reliability and safety.

Interconnecting Refrigerant Piping

The chiller and condenser refrigerant lines are terminated with a cap and brazed closed. Use a tube cutter to remove caps.

Caution! ***Do not use a saw to remove the end caps because this will allow copper chips to contaminate the system.***

A certified refrigeration contractor is needed to install the interconnecting refrigerant piping between the chiller and the outdoor air-cooled condenser and charge the unit with refrigerant. This piping must be properly sized, type "L" or type "K" refrigerant grade tubing, high temperature brazed.

Note: He must install a 400 PSI approved refrigerant relief valve in the discharge line at the condenser, following all codes.

When brazing copper joints, flow dry nitrogen through the system to prevent carbon/scale formation, which causes contamination. Isolate the refrigerant lines from the building, preventing transfer of line vibration to the structure. Do not secure the lines rigidly.

Leak check and evacuate the system down to 400 microns. A maximum decay of 50 microns after one hout is acceptable.

WARNING!To prevent injury or death due to explosion and/or inhalation of phosgene gas, purge system thoroughly while brazing refrigerant piping connections. Use a pressure regulator in the line between the unit and the high-pressure nitrogen cylinder to avoid over-pressurization and possible explosion.

System Configuration

The system can be configured in any of the arrangements shown on page **XX** of the Appendix. The configuration and distance between the chiller and the condenser affects pipe size, refrigerant charge, oil return, and oil charge. Therefore, there are limitations that must be adhered to for reliable and optimal operation.

- Leaving water temperature affects discharge line size. Be sure to inform the installing contractor of the leaving water temperature range in which the chiller will be operating. The charts following are to cover any application within the full operating range of the equipment. If the system is to be operated over a small range, it may be possible for the installing contractor to determine a more economical piping arrangement. The primary concern is to be sure that oil will be forced up the discharge line to the condenser when the compressor is unloaded to minimum capacity (approximately 30% of full capacity).
- The total distance between the chiller and condenser should not exceed 200 feet or 300 equivalent pipe feet.
- Refer to page **XX** of the Appendix for the location of traps.
- Refrigeration lines must not be crossed, i.e., chiller liquid lines are to be piped to condenser liquid lines.
- HFC134A refrigerant and the ester based oil are extremely hygroscopic and will absorb moisture from the ambient air very rapidly. It is imperative that the open time on lines and components that are connected to the compressors are held to an absolute minimum.

Sizing Refrigerant Lines

To determine field installed liquid and discharge line sizes, first establish the equivalent length of pipe for each line, valve, and elbow. Chiller capacity and leaving water temperature range are also required. See Figure 2 for lengths of refrigerant valves and fittings. Note that short radius elbows should only be used for double riser bottom trap. Long radius elbows should be used for all others.

Figure 2: Equivalent Length in Feet for Valves and Fittings

Line Size Inches OD	Globe Valve Equivalent Ft.	Angle Valve Equivalent Ft.	Short Radius Elbow Equivalent Ft.	Long Radius Elbow Equivalent Ft.	Tee Straight Through Equivalent Ft.
7/8”	22	9	2.0	1.4	1.4
1 1/8”	29	12	2.6	1.7	1.7
1 3/8”	38	15	3.3	2.3	2.3
1 5/8”	43	18	4.0	2.6	2.6
2 1/8”	55	24	5.0	3.0	3.3
2 5/8”	69	29	6.0	4.1	4.1
3 1/8”	84	35	7.5	5.0	5.0
3 5/8”	100	41	9.0	5.9	5.9
4 1/8”	120	47	10.0	6.7	6.7

Liquid Line Sizing

The liquid line should be sized as small as possible while maintaining acceptable pressure drop to minimize the refrigerant charge. Liquid line risers should not exceed 15 feet from the base of the air-cooled condenser. Horizontal runs do not require a pitch. Insulation is recommended to prevent heat losses/gains and condensation due to unusual ambient conditions. Install a liquid line-charging valve to facilitate refrigerant charging. See Figure 3 for liquid line sizing information. See Figure 6 for charge determination.

Figure 3: Liquid Line Sizing

30 – 65°F Leaving Water Temperature								
Liquid Line Size (O.D.")								
Equiv. Ft.	**35 hp**	**40 hp**	**50 hp**	**60 hp**	**70 hp**	**80 hp**	**90 hp**	**110 hp**
25	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8
50	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8
75	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8
100	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8
125	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8
150	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8
175	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8
200	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
225	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
250	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
275	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
300	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8

Discharge Line Sizing

For horizontal runs, the discharge line should be pitched downward, in the direction of flow at a rate of ¼" for every 10 feet. This will allow oil to flow towards the condenser. Discharge line sizing is based on the velocity required for sufficient oil return back to the compressor. See Figure 4 for horizontal and vertical flow down discharge line sizing and Figure 5 for vertical flow up discharge line or double riser sizing if required.

Figure 4: Discharge Line Sizing (Horizontal and Vertical Down Flow)

30 – 65°F Leaving Water Temperature								
Discharge Line Size (O.D.")								
Equiv. FT	**35 hp**	**40 hp**	**50 hp**	**60 hp**	**70 hp**	**80 hp**	**90 hp**	**110 hp**
25	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8
50	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8	3 1/8
75	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8
100	2 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	4 1/8
125	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	4 1/8
150	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8
175	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8
200	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8
225	2 5/8	2 5/8	3 1/8	3 5/8	3 5/8	3 5/8	4 1/8	4 1/8
250	2 5/8	2 5/8	3 1/8	3 5/8	3 5/8	3 5/8	4 1/8	4 1/8
275	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	3 5/8	4 1/8	4 1/8
300	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	4 1/8

Double Risers (Up Flow) required in shaded areas – see Figure 5 for riser sizing

Figure 5: Discharge Line Double Riser Sizing (Vertical Up Flow)

30 – 65°F Leaving Water Temperature								
Discharge Line Size (O.D.")								
Equiv. FT	**35 hp**	**40 hp**	**50 hp**	**60 hp**	**70 hp**	**80 hp**	**90 hp**	**110 hp**
25	1 5/8	1 3/8 & 1 5/8	1 3/8 & 1 5/8	1 3/8 & 1 5/8	1 3/8 & 1 5/8	1 5/8 & 2 1/8	1 5/8 & 2 1/8	1 5/8 & 2 1/8
50	1 3/8 & 1 5/8	1 3/8 & 1 5/8	1 3/8 & 1 5/8	1 5/8 & 2 1/8	1 5/8 & 2 1/8	1 5/8 & 2 1/8	1 5/8 & 2 1/8	1 5/8 & 2 5/8

Double Risers required in shaded areas.

Refrigerant Charge Determination

The approximate amount of refrigerant charge required by the system varies based on the total length of the refrigerant lines and the size of the chiller. Referring to Figure 6, determine the amount of charge based on discharge and liquid line sizes and lengths. Add these four numbers together to find the total operating charge.

Figure 6: Refrigerant Charge Determination (per circuit)

Chiller Charge

Horsepower	Lbs. of R134a
35	20
40	25
50	30
60	35
70	40
80	50
90	55
110	65

Air Cooled Condenser Charge

Horsepower	Lbs. of R134a
35	19
40	24
50	29
60	29
70	36
80	43
90	50
110	58

Field Installed Piping Charge

Pipe O.D. Inches	Discharge Line ℵ R134a (Lbs.)	Liquid Line ℵ R134a (Lbs.)
7/8”	1.0	24.3
1 1/8”	1.7	41.4
1 3/8”	2.6	63.0
1 5/8”	3.6	89.2
2 1/8”	6.3	155.1
2 5/8”	9.7	239.2
3 1/8”	13.9	341.4
3 5/8”	18.8	461.8
4 1/8”	24.4	600.2

ℵ Based on 100 feet of pipe, 100°F Liquid, 100°F Discharge

Verify Correct Charge

The final operating charge must be verified by running the system and checking the liquid line sight glass as well as the sub-cooling.

The system should have at least enough load to run one compressor fully loaded in order to properly verify operating charge.

Typical condensing pressure with a full load and 95°F ambient air over the condenser will be 170 PSI or HFC 134a. Each circuit should be charged to maintain 10°F sub-cooling under these conditions.

Checking Motor Direction

Compressor

Caution! ***Check Compressor Rotation Before Starting Unit!***
Connect a phase monitor and phase incoming power ABC.

Note:

- Unit must be wired in sequence (ABC) and checked before start up.
- Never switch contactor leads or motor leads for reversing rotation.
- Do **not** use contactor or motor leads for phase matching.
- Compressor damage will occur if the compressor is run in reverse. The compressor motor protector checks for correct phasing and will not allow it to start in reverse.
- If you discover that phasing is reversed, correct it by switching any two **main** power leads **into the disconnect switch or distribution block** on the unit.

Water Pump

A positive pressure of ≥ 20 to 30 psi (137.9 to 206.8 kPa/1.38 to 2.07 bars) on the **TO PROCESS** line indicates correct pump rotation.

Condenser Fan

On central chillers with remote air-cooled units, air should draw through the condenser and discharge up from the condenser.

Changing fan rotation direction

- Disconnect and lock out power at the fused disconnect.
- If all fans are going backwards, reverse any two main power leads.
- If only some of the fans are going backwards, switch any two of their respective motor leads.

3-5 Initial Start-up

Pre-Startup Checks

Note: ***These lists assume the installation information in this manual have been read and followed.***
Have new chillers started up and checked by a qualified refrigeration service technician.
The manufacturer offers factory startup for your Screw Compressor Central Chiller. Call the Manufacturers' Service Department at for more details.

Water-Cooled Central Chiller

1. Check the shipping papers against the serial tag to be sure chiller size, type and voltage is correct for the process.
2. Check the transformer primary voltage connections to be sure they are configured for the electrical power you are using.
3. The voltage at the main power connection must be within plus or minus ten percent (±10%) of the voltage listed on the serial tag.
4. Phase imbalance must be less than two percent (<2%).
5. Unit must be wired in sequence (ABC).
6. Electrical connections must conform to all applicable codes.
7. Power must be turned on to unit 24 hours prior to start up for the compressor crankcase heater.
8. Complete the chilled water **TO** and **FROM PROCESS** connections.
9. The chilled water supply and return valves on the chiller must be open.
10. Be sure the pump tank and chilled water circuit are filled with a water/glycol mixture that provides freeze protection to 20°F (12ºC) below the leaving water temperature you want.
11. Complete the tower or city condenser **WATER IN** and **WATER OUT** connections. Provide an adequate condenser water supply; 2 gpm per ton for city water or 3 gpm per ton for tower water operation.
12. Remove all tools, foreign matter and debris from the pump tank reservoir and piping.
13. Complete all piping leading to and from the pump tank. Observe all applicable codes.
14. Complete all electrical wiring. Observe all applicable codes.
15. Tighten all electrical connections.
16. Prepare all related equipment in the system for operation.
17. Check for proper compressor rotation direction. To confirm proper rotation:
    a. Connect a phase meter and phase incoming power ABC.

    Note:

    - ***Never switch contactor leads or motor leads for reversing rotation.***
    - ***Do not use contactor or motor leads for phase matching.***
    - ***Compressor damage will occur if the compressor is run in reverse. The compressor motor protector checks for correct phasing and will not allow it to start in reverse.***
    - ***If you discover that compressor rotation is reversed, correct it by switching any two main power leads into the disconnect switch or distribution block on the unit.***
18. Open the 1" (approx. 25 mm) makeup water valve and allow the tank to fill until the automatic float valve shuts off. The float level should be adjusted so the standing water level is 8" (20 cm) from the top of the tank.

19. Close the discharge butterfly valve then crack it open; open all pump suction butterfly valves fully, then start the pump and observe the gauge.
20. Check for proper pump rotation direction. To confirm proper rotation:
    a. Observe a pump pressure gauge connected to the suction and discharge sides of the pump casing through two ¼" (approx. 6.4 mm) gauge cocks.
    b. Close the gauge cock leading to the pump suction and open the gauge cock leading to the pump discharge.
    c. Close the discharge butterfly valve, crack it open, then start the pump and observe the gauge.
        1. If the gauge indicates within 15 psi (103.4 kPa/1.03 bars) below the pump curve, pump rotation is correct. **Pump rotation is clockwise opposite the shaft end**.
        2. If the gauge indicates 20 psi (137.9 kPa/1.38 bars) or more below the pump curve, the pump is running backwards. Reverse rotation by interchanging any two power mains to the pump starter.
        3. Recheck the pressure to be sure it increased.
21. Check the water level in the pump tank to be sure the pump does not run dry while the system piping is being filled.
22. Once the system is full, open the pump discharge butterfly valve fully.
23. Check your work and proceed to the Startup procedure.

Remote Air-Cooled Central Chiller Startup Checklist

1. Check the shipping papers against the serial tag to be sure chiller size, type and voltage is correct for the process.
2. Check the transformer primary voltage connections to be sure they are configured for the electrical power you are using.
3. The voltage at the main power connection must read within plus or minus ten percent (±10%) of the voltage listed on the serial tag.
4. Phase imbalance must be less than two percent (<2%).
5. Unit must be wired in sequence (ABC).
6. Electrical connections must conform to all applicable codes.
7. Tighten all electrical connections.
8. Complete the chilled water **TO** and **FROM PROCESS** connections.
9. The optional or field installed chilled water supply and return valves must be open.
10. The power needs to be on 24 hours prior to starting the unit for the crankcase heater.
11. Be sure the tank and chilled water circuit piping are filled with a water/glycol mixture. The water/glycol mix should provide freeze protection to 20°F below the leaving water temperature you've selected.
12. The air cooled condenser should have an adequate supply of air for proper operation.

13. Check condenser fans for pressure switch settings as shown in the table below:

Fan number	Set on			Set off		
	psi	KPa	bars	psi	kPa	bars
1	not applicable; Fan 1 is a variable-speed fan					
2	140	1,069	10.7	105	828	8.3
3	150	1,172	11.7	115	931	9.3
4	160	1,276	12.8	125	1,035	10.3
5	170	1,379	13.8	135	1,138	11.4

14. Connect the main power to the unit and bump-start it to check for proper rotation direction. If the fans are operating backwards, reverse any two main power leads at the incoming terminal block.
15. Remove all tools, foreign matter and debris from the pump tank reservoir and piping.
16. Complete all piping leading to and from the pump tank. Observe all applicable codes.
17. Complete all electrical wiring. Observe all applicable codes.
18. Prepare all related equipment in the system for operation.
19. Check for proper compressor rotation direction. To confirm proper rotation, connect a phase meter and phase incoming power in sequence (ABC).

    Note:

    - *Never switch contactor leads or motor leads for reversing rotation.*
    - *Do **not** use contactor or motor leads for phase matching.*
    - *Compressor damage will occur if the compressor is run in reverse. The compressor motor protector checks for correct phasing and will allow it to start in reverse.*
    - *If you discover that compressor rotation is reversed, correct it by switching any two **main** power leads **into the disconnect switch or distribution block** on the unit.*

20. Open the 1" (approx. 25 mm) makeup water valve and allow the tank to fill until the automatic float valve shuts off. The float level should be adjusted so the standing water level is 8" (20 cm) from the top of the tank.
21. Check for proper pump rotation direction. To confirm proper rotation:
    a. Observe a pump pressure gauge connected to the suction and discharge sides of the pump casing through two ¼" (approx. 6.4 mm) gauge cocks.
    b. Close the gauge cock leading to the pump suction and open the gauge cock leading to the pump discharge.
    c. Close the discharge butterfly valve then crack it open, open the pump suction butterfly valve fully, then start the pump and observe the gauge.
        1. If the gauge indicates within 15 psi (103.4 kPa/1.03 bars) below the pump curve, pump rotation is correct. **Pump rotation is clockwise opposite the shaft end**.

2. If the gauge indicates 20 psi (137.9 kPa/1.38 bars) or more below the pump curve, the pump is running backwards. Reverse rotation by interchanging any two power mains to the pump motor or starter.
3. Recheck the pressure to be sure it increased.

22. Check the water level in the pump tank to be sure the pump does not run dry while the system piping is being filled.
23. Open the discharge fully when system is filled.
24. Check your work and proceed to the Startup procedure in the following section.

Determining Chilled Water Flow Rate

To determine flow:

1. Close the gauge cock leading to the pump suction side and open the gauge cock leading to the pump discharge.
2. Start the pump and make note of the discharge pressure in psi (kPa/bars).
3. Check the pump curve for the appropriate horsepower pump at the discharge pressure psi.
4. Project this point down to find the flow in gpm (lpm).
5. Process pumps can be left wide open if running amps are below full load amps.

Chapter 4: Operation

4-1 Start-up

Water & Remote Air-Cooled Central Chiller Startup

1. Start the chiller by pushing the **Start** button on the control panel of the unit.
2. The touchscreen will display the Main Menu screen.
3. If your chiller has been setup to control the pump tank, the recirculation pump will turn on first, then after 5 seconds the process pump will turn on. If configured with a standby pump, the lead/lag will control which pump turns on. See control instructions on page 41 on how to do this.
4. Fifteen (15) seconds after the last pump turns on the first compressor will turn on. Based on the temperature of the water the controller will turn on compressors every 15 seconds.
5. Adjust the Freezestat cut-out, located in the main electrical enclosure, to 10°F (6ºC) below the process temperature set point you want. See page 19 for instructions.

   Note: If the recirculation pump does not turn on (or that the flow switch is not satisfied) the compressors will not be allowed to turn on and you should get a no flow alarm.
6. Check the pump(s) amp draws and pressures. The amp draws must be within the pump(s) running load amps.
7. Operate the chiller, looking for leaks and listening for unusual noises or vibrations that could indicate improper operation.

4-2 Controller Description

Identifying Control Panel Indicator Lights and Switches for the Standard and Advanced Controllers

System On

The green **System On** indicator lights when the main power switch is on and the control circuit is energized.

Start

The **Start** push-button lets you energize the unit.

Stop

The **Stop** push-button lets you de-energize the unit.

Touchscreen Interface

The touchscreen interface gives you control over the chilling station. It has an easy-to-use control menu that lets you quickly change or adjust chiller settings and also gives you all the operation information you need to control the unit effectively.

See Page 33 for more information on the Standard touchscreen interface operation. See Page 45 for more information on the Advanced touchscreen interface operation.

Figure 1: Standard Touchscreen Controller

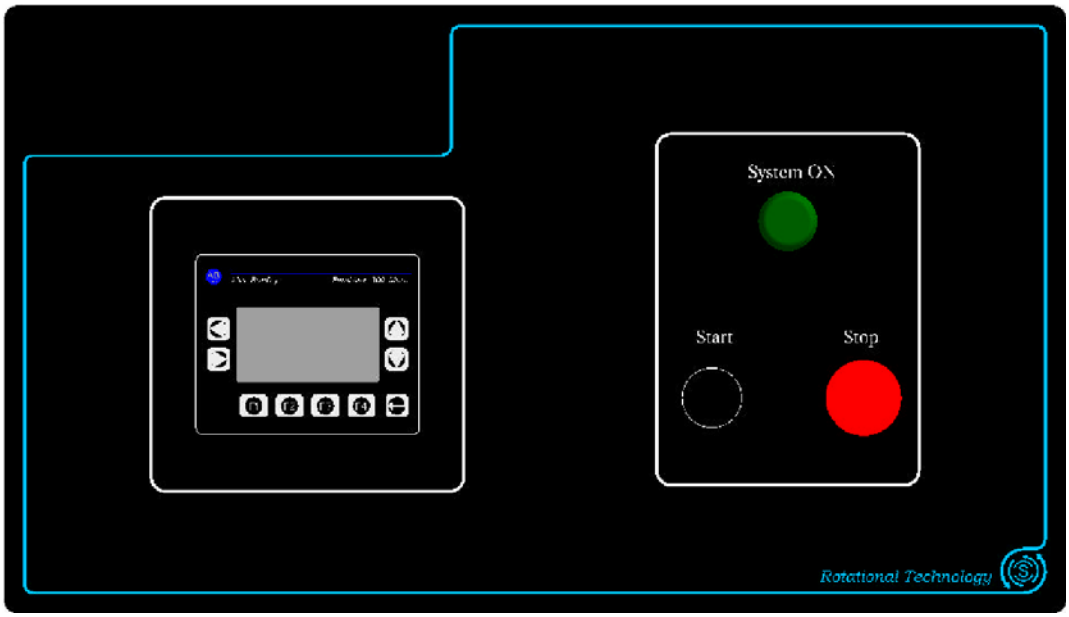
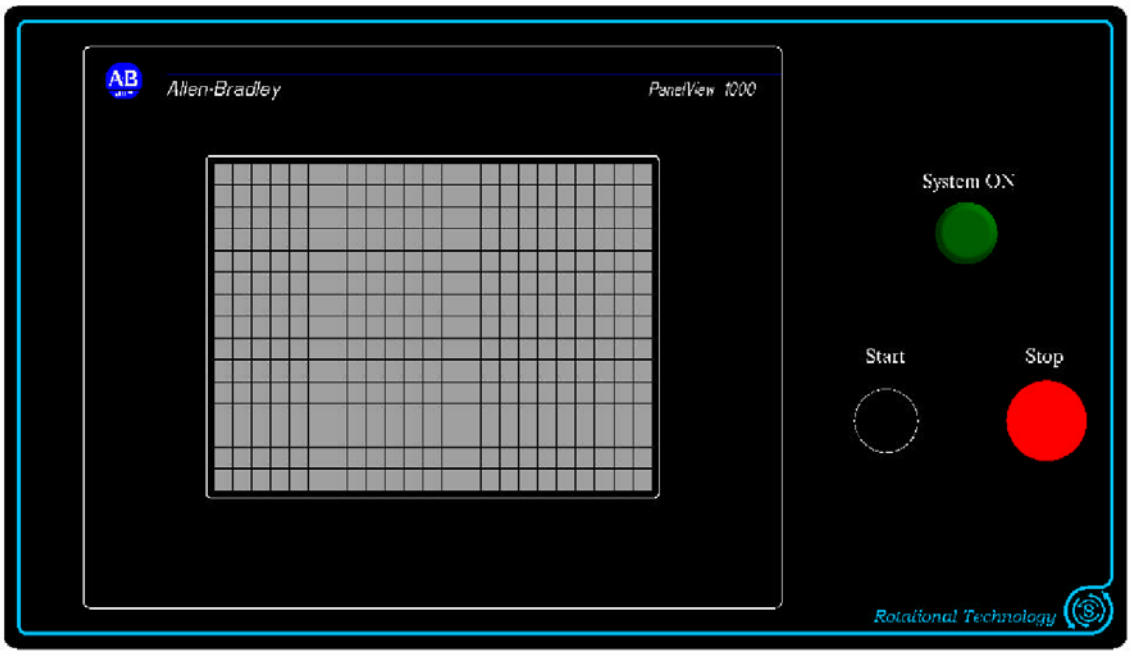


Figure 2: Advanced Touchscreen Controller



4-3 Controller Operation (Standard Controller)

Using the Standard Touchscreen Interface

Introduction

The Standard touchscreen interface lets you control your Screw Compressor central chilling station. You can do such things as:

- Control compressors and optional pumps
- View current statuses of operation, such as pressures, temperatures, and capacities
- Handle alarm conditions

This section lists special instructions for operating the standard touchscreen interface.

Note: The screens shown in this section are sample ***screens. Actual screen representations may be slightly different in appearance, but are no different in operation.***

On all screens in this controller, the **F4** button is reserved for the previous screen function. Some screens, such as the chiller status screen, do not have sufficient space to display a prompt that the **F4** performs this function. However, the **F4** button will always move to the previous screen and will eventually return to the Main Menu.

The Standard touchscreen interface is the "manager" of your central chilling station. The screen contains screen buttons you can press to control system operation.

For example, if you need to resolve an alarm condition, press the or buttons on the right side of the screen to highlight "**ACTIVE ALARM LIST**". The screen will tell you what alarm is active and you may clear the alarm by touching the **F1** button located to the lower left of the terminal.

To return to the Main Menu screen at this point, press the **F4** button of the terminal, located in the lower right corner. The Main Menu screen then displays.

Some screens let you directly control the operation of the chilling station, while others are for information purposes and are "display-only" screens. This section distinguishes between operation and display screens.

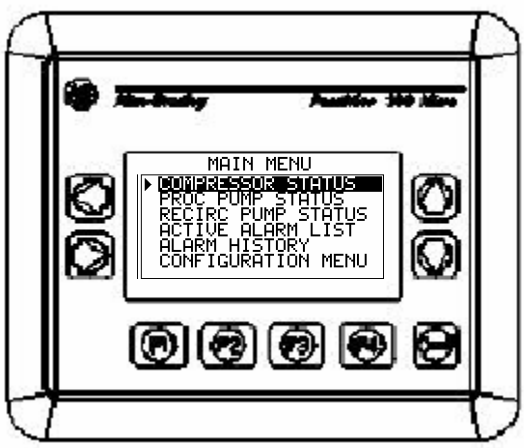
Main Menu Screen

To start the Standard touchscreen interface:

- Push the **ON/OFF** button on the cabinet.

The chillers' control panel energizes and the **System On** indicator turns on.

The Main Menu screen displays:



Main Menu Screen

The Main Menu screen lets you gain access to:

- "**COMPRESSOR STATUS**" contains the compressor status display screen
- If the chiller was configured to operate the chilled water pump tank, the "**PROC PUMP STATUS**" is displayed. This screen contains the process pump status.
- "**RECIRC PUMP STATUS**" contains the recirculation pump status if the chiller was configured to operate the chilled water pump tank.
- "**ACTIVE ALARM LIST**" shows all of the active alarms. Those alarms which are currently preventing the chiller from functioning, if fatal alarm, or those that show a condition which needs to be looked at in a short period of time.
- "**ALARM HISTORY**" contains the last twenty-five (25) alarms that were activated.
- "**CONFIGURATION MENU**" contains the chiller setup parameters (i.e. chiller setpoint, and high and low temperature alarm setpoints)
- "**HOUR METERS**" this screen shows the amount of time that the compressor or pump has been operating.

The following sections in this chapter list the information you need to navigate through these screens for monitoring and operating your central chilling station with the Standard Control Package.

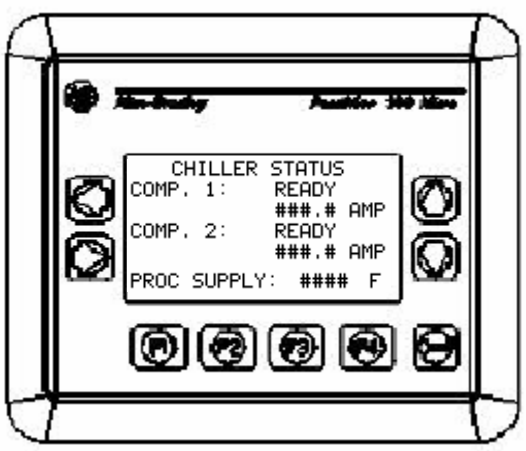
Compressor Status Screen

To view the status of the chiller compressors, start at the Main Menu screen, then:

1. Press the ▲ or ▼ buttons on the right side of the screen to highlight "**COMPRESSOR STATUS**"

2. Press ↵

The compressor status screen displays:



Compressor Status Screen

The Compressor Status screen shows the status for compressors within the system. Only compressors that are included in the system will be shown on this screen. Compressors will display one of the following states:

1. **OFFLINE** – This indicates that the compressor has been turned off in the compressor enable/disable screen. The compressor will not be called to operate until it has been re-enabled.
2. **READY** – Indicates that the compressor is enabled and ready to run. However, the current loading does not require the compressor to be running. This compressor will be automatically started when needed.
3. **RUNNING** – Compressor is currently running.
4. **FAULT** – A safety on the compressor indicates a fault condition and the compressor has been deactivated. Once the problem is remedied, the compressor will return to a READY state unless it is put in the OFFLINE state.

Process and Recirculation Pump Status Screens

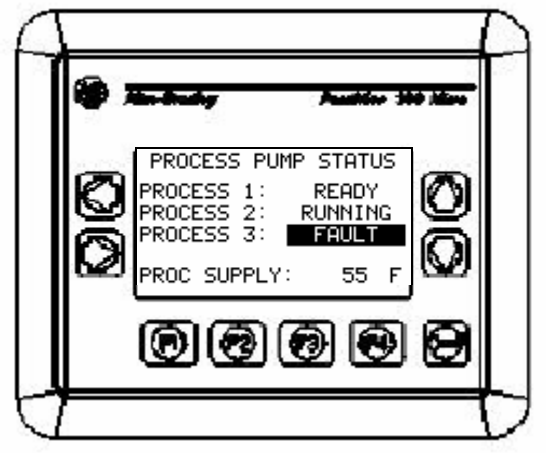
Note: If your chiller system was configured to operate the pump(s) of the chilled water pump tank, the user may view the status of the process and recirculation pumps.

To view the status of the pumps, start from the Main Menu, then:

1. Press the ▲ or ▼ buttons to highlight either "**PROC PUMP STATUS**"or "**RECIRC PUMP STATUS**".

2. Press ↵

The Pump Status Screen appears



Pump Status Screen

Only pumps that are enabled in the system will be shown on this screen. Pumps will display one of the following states:

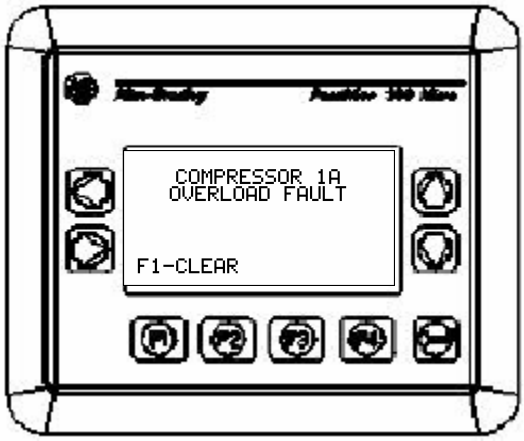
1. **OFFLINE** – This indicates that the pump has been turned off in the pump enable/disable screen. The pump will not be called to operate until it has been re-enabled.
2. **READY** – Indicates that the pump is enabled and ready to run. However, the current number of pumps specified to run does not require this pump to operate.
3. **RUNNING** – Pump is currently running.
4. **FAULT** – A safety on the pump indicates a fault condition and the pump has been deactivated. Once the problem is remedied, the pump will return to a READY state unless it is put in the OFFLINE state.

Active Alarm List and Alarm History Screens

These two screens let you view any active alarm conditions as well as the alarm history or the entire history. The list of system alarms that are tracked are as follows:

- Chilled Water High Temperature Alarm
- Chilled Water Low Temperature Alarm
- Compressor Motor Protector Fault (One for each compressor)
- Chilled Water Circuit Low Flow (One per chilled water circuit)
- Chilled Water Circuit Freezestat (One per chilled water circuit)
- Chilled Water Circuit High Pressure (One per chilled water circuit)
- Chilled Water Circuit Low Pressure (One per chilled water circuit)
- Pump motor overload (One per system pump)

If an alarm condition occurs the follow screen is displayed:



Alarm Condition Screen

To acknowledge the alarm, press **F1** to clear the alarm. It will then appear in the alarm history screen. Except for High and Low Water Temperature, and Low Refrigerant Pressure, these alarms are considered fatal and maintenance must be preformed in order to allow the chiller to fully run. Should a compressor or pump turn off from an alarm condition, the remaining will shut down and display **FAULT** in the status screen for the device.

Once a device has gone offline you will need to contact a licensed professional (electrician or refrigeration sevice company) to bring the device back online.

Caution!

Never attempt to service a unit until a qualified electrician has opened and locked out the main disconnect using OSHA 1910.147 standards.

All electrical connections must be done by a qualified electrician.

WARNING!*Disconnect all power to the unit, let the unit cool down, and turn off the water* **prior to any servicing.**

Failure to do so can result in SERIOUS INJURY OR DEATH!

Configuration Menu Screen

This screen allows the operator to configure the settings for the compressors, pumps, chiller setpoint, and high and low temperature alarm setpoints.

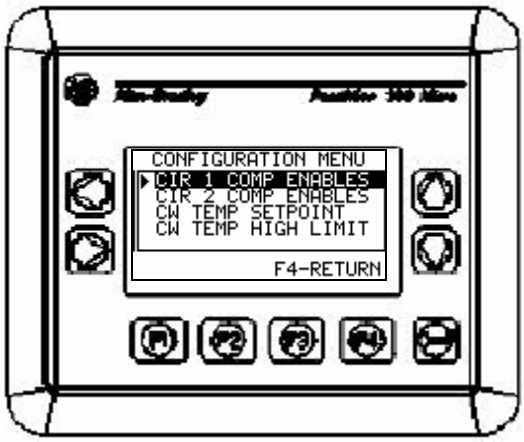
Operating the chiller compressors

To enable or disable the individual compressors, start at the Main Menu, then:

1. Press the ▲ or ▼ buttons on the right side of the screen to highlight "**CONFIGURATION MENU**"

2. Press the ↵ button

The configuration menu screen displays:

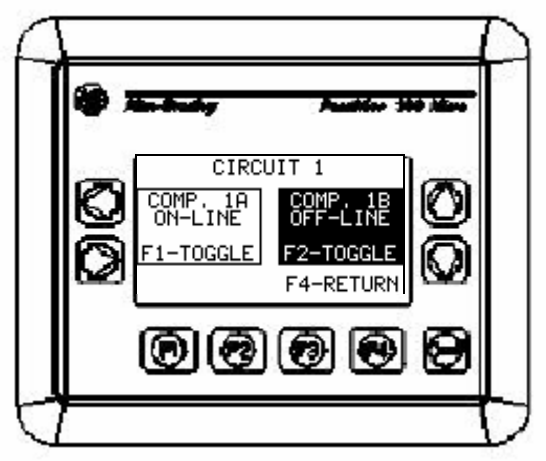


Chiller Configuration Screen

3. Press the ▲ or ▼ button to highlight either "**CIR 1 COMP ENABLES**" or "**CIR 2 COMP ENABLES**"

4. Press the ↵

The compressor enable screen displays:



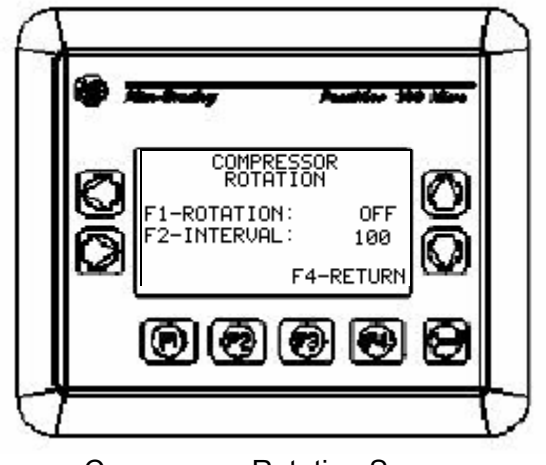
Compressor Enable Screen

These screens allow the customer to toggle the compressors between ON-LINE and OFF-LINE. As the operator presses the F1 or F2 button, the corresponding compressor state changes between ON-LINE and OFF-LINE. Press F4 to leave this screen.

Setting Compressor Rotation Times
and Activating Compressor Lead/Lag Operation

While in the **Configuration Menu**, the compressor rotation screen allows the customer to enable or disable the rotation of compressors. While viewing the screen for the applicable rotation, pressing **F1** will toggle the rotation function On or Off. Pressing the **F2** button will present an entry screen which will allow the entry of a rotation interval. Use the ▲ and ▼ arrows to change the number of hours. Acceptable range is 50-200 hours.

The compressor rotation screen displays:



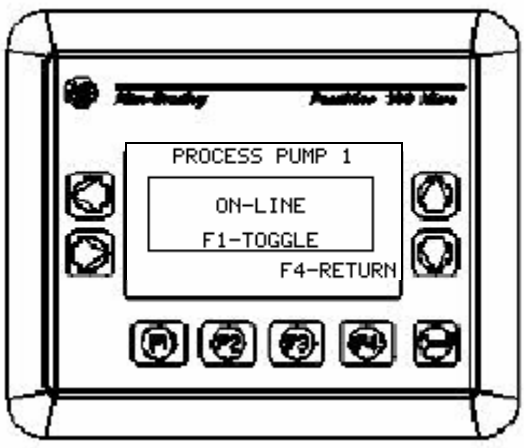
Compressor Rotation Screen

Operating Chiller Pumps

To turn on and off the pumps, start from the Main Menu, then:

1. Press the ▲ or ▼ buttons to highlight either "**CONFIGURATION MENU**".
2. Press ↵
3. Highlight "**PUMP ENABLES**"
4. Press ↵
5. Highlight the pump you want to operate.

The Pump Enables Screen appears



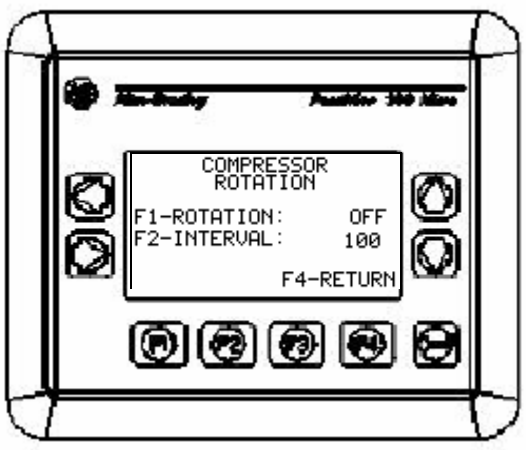
Pump Enables Screen

Any pump that is disabled to the OFF-LINE position will not be called to operate. Simply toggle the **F1** key on the enable/disable screen to toggle the state of the pump from the ON-LINE to OFF-LINE state.

Setting Pump Rotation Times
and Activating Pump Rotation Operation

While in the Configuration Menu, the pump rotation screen allows the customer to enable or disable the rotation of compressors. While viewing the screen for the applicable rotation, pressing **F1** will toggle the rotation function On or Off. Pressing the **F2** button will present an entry screen which will allow the entry of a rotation interval. Acceptable range is 50-200 hours.

The compressor rotation screen displays:



Compressor Rotation Screen

Viewing and Setting System Temperatures

To view the actual process temperature, select the "**COMPRESSOR STATUS**", "**PROC PUMP STATUS**", or the "**RECIRC PUMP STATUS**" screens from the main menu. The process temperature is located on the bottom-right of the screen.

For example, the compressor status displays:

Compressor Status Screen

Note: ***If you have a metric version of the Central Chiller controller, the screens display in converted metric values.***

Setting System Temperatures

The chiller setpoints are set through the configuration menu. Starting from the Main Menu:

1. Press the ▲ or ▼ buttons to highlight "**CONFIGURATION MENU**"
2. Press ↵
3. Highlight "CW TEMP SETPOINT", "CW TEMP HIGH LIMIT", or "CW TEMP LOW LIMIT"
4. Press ↵
5. While on the parameter screen, simply press the **F1** button to make the parameter change. A numeric entry screen will appear. Use the ◄ and ► buttons to select the digit, and the ▲ and ▼ buttons to increase and decrease that digit. Once the value is correct, press the ↵ button to make the change. In the event that the value is outside the range specified by MAX or MIN, the value entered will be the corresponding MAX or MIN.

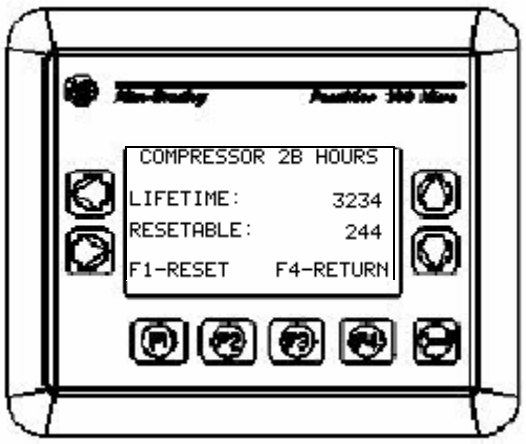
Hourmeters Screen

Viewing Compressor Run Times

From the Main Menu, use the ▲ or ▼ buttons to highlight the "**HOURMETERS**" menu. Scroll to select the compressors. Then press ↵ to display the hourmeter.

Note: this is a complete list of all components that may be included in the system. Any component that is not included in the system will not accumulate time.

The Compressor Run Time screen displays:



Compressor Run Time Display Screen

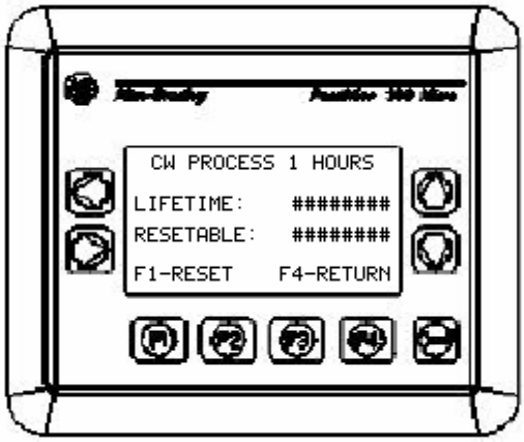
Two hourmeters are kept for each compressor in the system. The first is a lifetime meter. This measures the total time that the compressor has been operational in the lifetime of the chiller. The second is a resettable hourmeter. This hourmeter can be cleared to monitor run time on specific intervals. In order to clear the resettable hourmeter, press the **F1** button (as prompted on the screen)

Viewing Pump Run Times

From the Main Menu, use the ▲ or ▼ buttons to highlight the "**HOURMETERS**" menu. Scroll to select the pump. Then press ↵ to display the hourmeter.

Note: this is a complete list of all pumps that may be included in the system. Any pump that is not included in the system will not accumulate time.

The Pump Run Time screen displays:



Compressor Run Time Display Screen

Two hourmeters are kept for each compressor in the system. The first is a lifetime meter. This measures the total time that the pump has been operational in the lifetime of the chiller. The second is a resettable hourmeter. This hourmeter can be cleared to monitor run time on specific intervals. In order to clear the resettable hourmeter, press the **F1** button (as prompted on the screen).

4-4 Controller Operation (Advanced Controller)

Using the Advanced Touchscreen Interface

Introduction

The Advanced touchscreen interfaces let you control your Screw Compressor Central Chilling station. You can do such things as:

- Control compressors and optional pumps
- View current statuses of operation, such as pressures, temperatures, and capacities
- Handle alarm conditions

This section lists special instructions for operating advanced touchscreen interfaces.

Note: ***The screens shown in this chapter are*** sample ***screens. Actual screen representations may be slightly different in appearance, but are no different in operation. Also, the PLC is configured based on options and system configuration at the time of order. These screens are the basic ones to startup the chiller.***

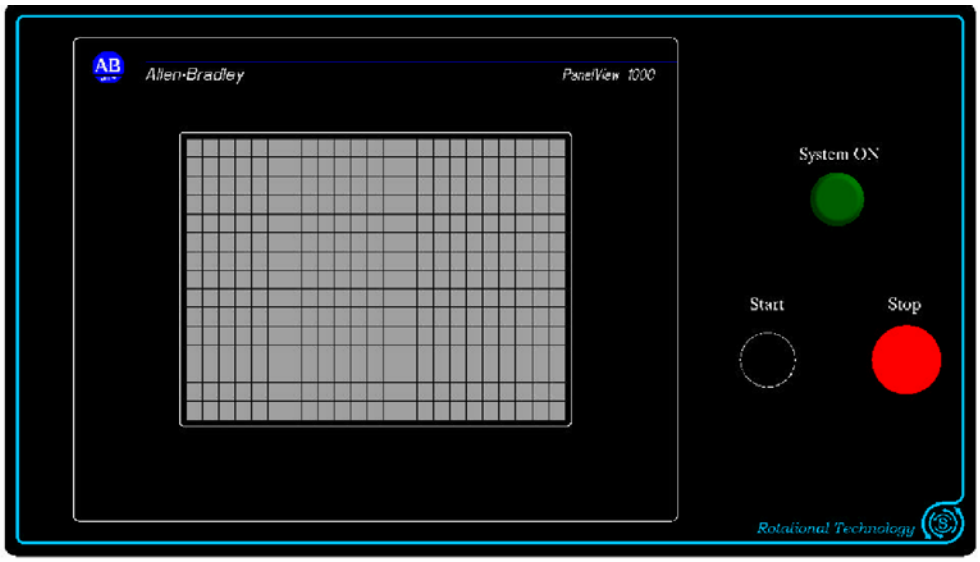
The Advanced touchscreen interface is the "manager" of your screw compressor central chilling station. This screen contains screen buttons you can press to control system operation.

For example, if you need to resolve an alarm condition, press the Up or Down arrow buttons on the right side of the screen to highlight "**ACTIVE ALARMS**". Press ↵ and the screen will display all active alarms.

To return to the Main Menu screen at this point, press the **Menu** button on the screen, located in the lower right corner. The Main Menu screen then displays.

Some screens let you directly control the operation of the chilling station, while others are for information purposes and are "display-only" screens. This section distinguishes between operation and display screens.

Figure 3: Advanced Touchscreen Controller



Accessing the Main Menu Screen

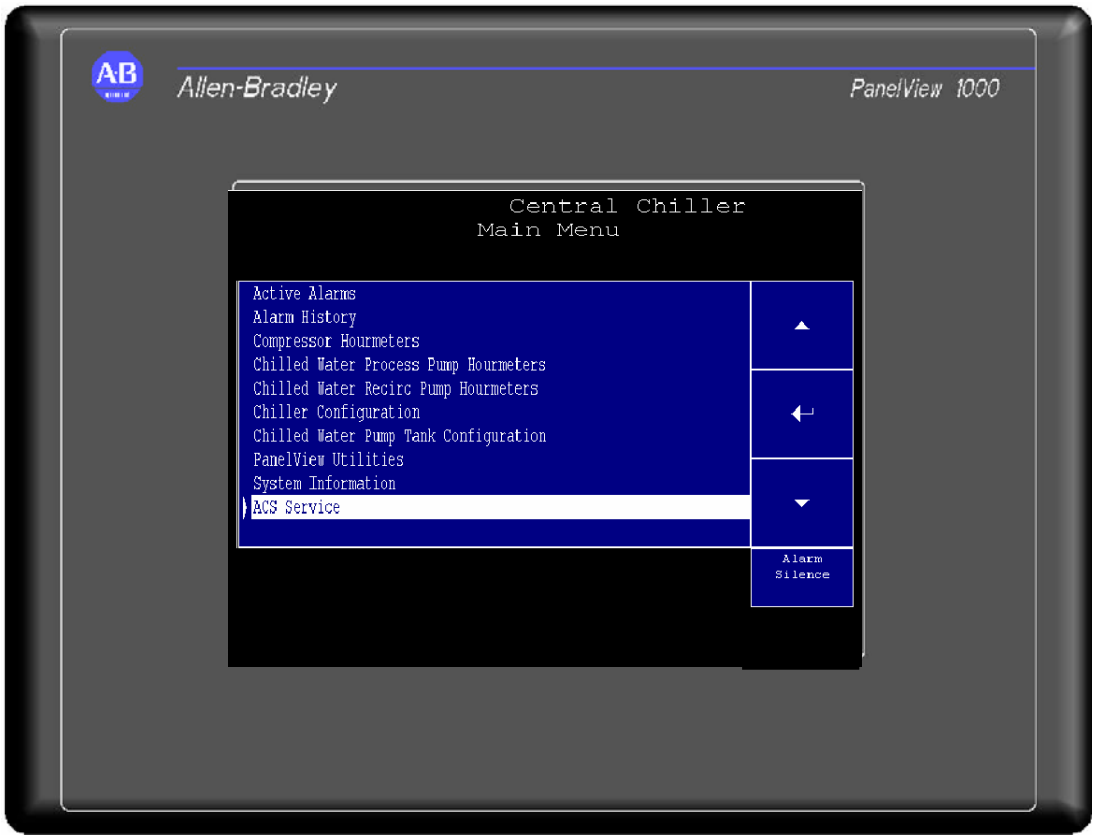
To start the Central Chiller Advanced touchscreen interface:

- Push the **ON/OFF** button on the cabinet.

The chiller control panel energizes and the **System On** indicator turns on.

The Main Menu screen displays:

Figure 4: Main Menu Screen



The Main Menu screen lets you gain access to:

- "**Chilled Water System Status"** contains information on the status of the compressors and pumps within the system.
- "**Active Alarms**" contains the current alarm(s) of the system
- "**Al;arm History**" contains the last thirty (30) alarms that were activated.
- If the chiller was configured to operate the chilled water pump tank, there are three screens to configure and view the pump tank setup. The configuration screen allows for the user to turn on or off any of the pumps as well as configuring the lead/lag rotation (if multiple pumps were configured)
- "**Chiller Configuration**" shows the configuration of the chiller itself including the chiller temperature setpoint, temperature alarm settings, as well as setting up the lead/lag rotation, and the ability to turn on and off the compressors.

- "**Compressor Hourmeters**" contains the lifetime and resettable hour meters to show the number of hours that the compressors have been running
- "**Chilled Water Process Pump Hourmeters**" and "**Chilled Water Recirc Pump Hourmeters"** contains the lifetime and resettable hour meters to show the number of hours that the process and recirculation pumps have been running.
- "**PanelView Utilities**" and "**ACS Service**" are both password protected sections of the PLC that are used to configure the display and the initial configuration of the chiller and system.

The following sections in this chapter list the information you need to navigate through these screens for operating and monitoring your central chilling station with the Advanced Control Package.

Viewing Compressor Status

Staging

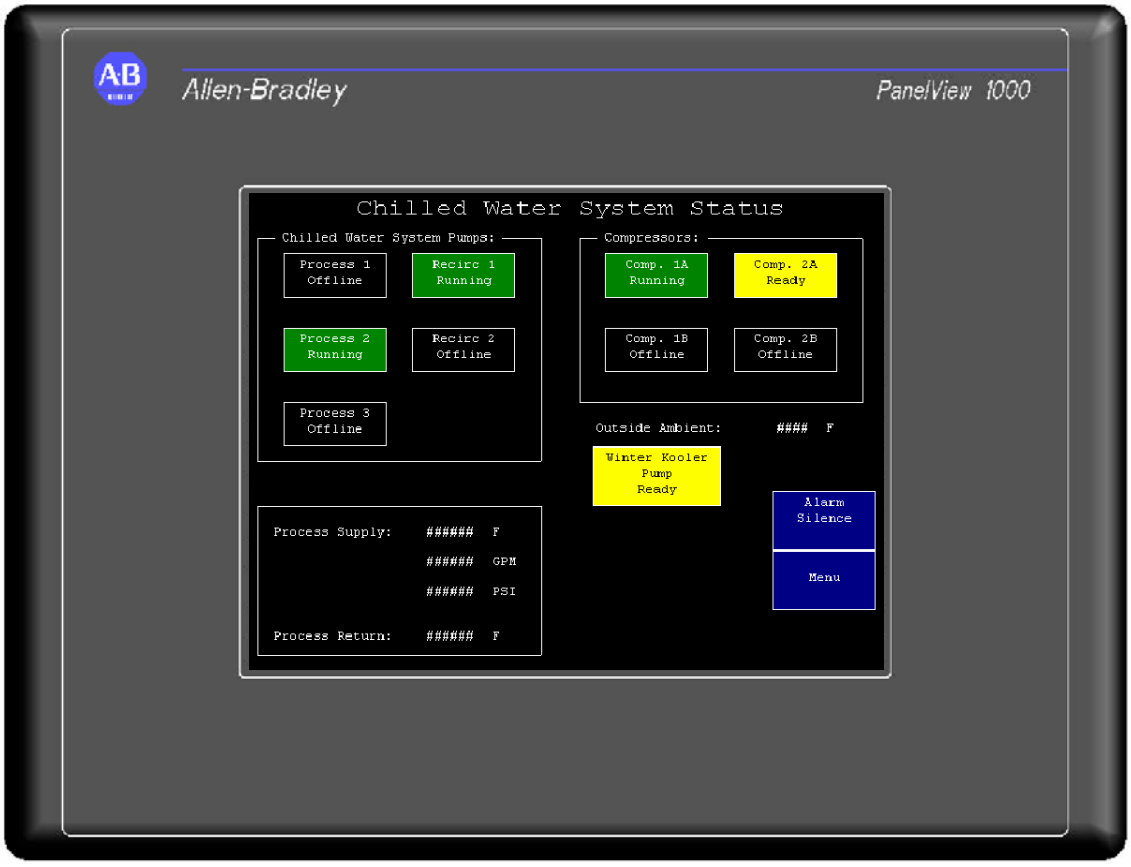
1. The system uses a PID control algorithm to regulate the chilled water temperature. As the required control effort increases or decreases, the system compressors are loaded and unloaded or turned on/off to keep the temperature at the specified set-point.
2. Compressor anti-recycle time is two (2) minutes.

To view the status of the chiller compressors, start at the Main Menu screen, then:

1. Press the Up or Down buttons on the right side of the screen to highlight "**Chilled Water System Status**"
2. Press ↵

The chiller status screen displays:

Figure 5: Chilled Water System Status Screen



The Chiller Status screen shows the status for compressors within the system. Only compressors that are included in the system will be shown on this screen. Compressors will display one of the following states:

1. **OFFLINE** – This indicates that the compressor has been turned off in the compressor enable/disable screen. The compressor will not be called to operate until it has been re-enabled. The color code for this indication is black.
2. **READY** – Indicates that the compressor is enabled and ready to run. However, the current loading does not require the compressor to be running. This compressor will be automatically started when needed. The color code for this indication is yellow.
3. **RUNNING** – Compressor is currently running. The color code for this indication is green.
4. **FAULT** – A safety on the compressor indicates a fault condition and the compressor has been deactivated. Once the problem is remedied, the compressor will return to a READY state unless it is put in the OFFLINE state. The color code for this fault indication is red.

Viewing Chiller Pump Status

Note: ***If your chiller system was configured to operate the pump(s) of the chilled water pump tank, the user may view the status of the process and recirculation pumps.***

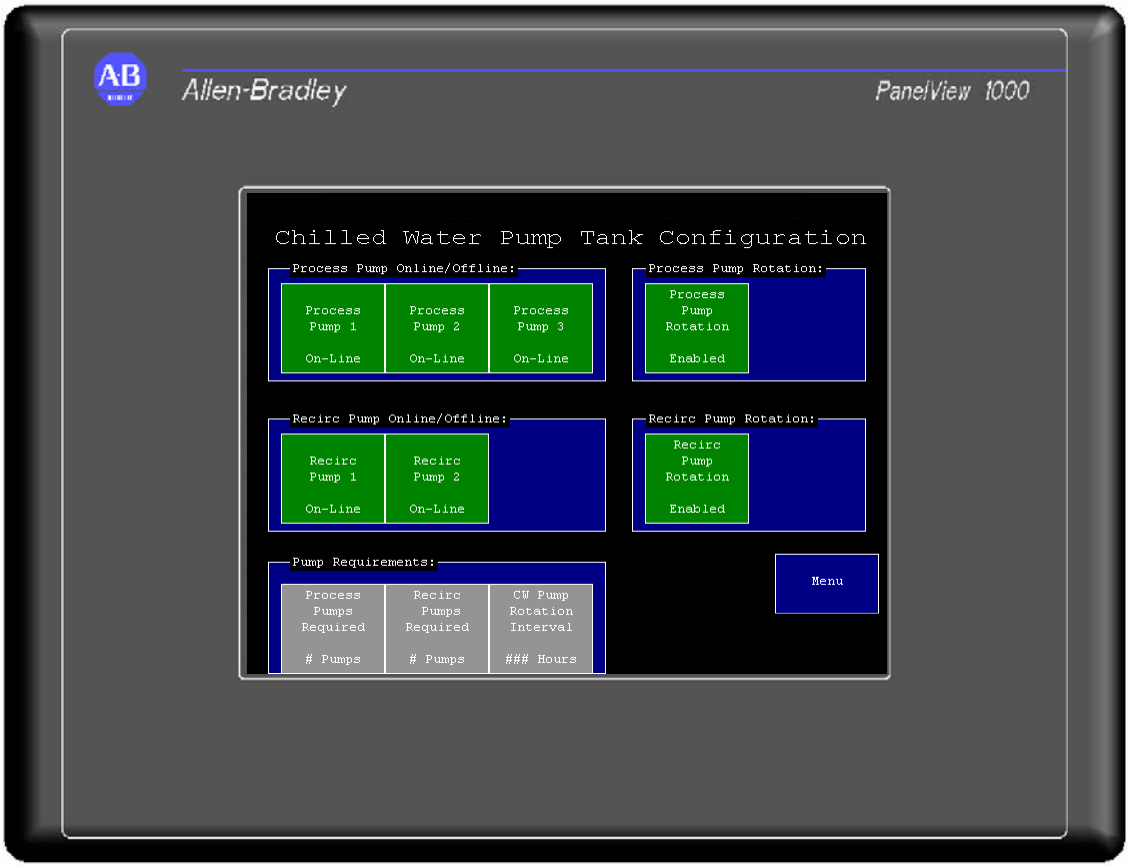
To view the status of the pumps, start from the Main Menu, then:

1. Press the Up or Down buttons to highlight "**Chilled Water Pump Tank Configuration**".

2. Press ↵

The Chilled Water Pump Tank Configuration Screen appears:

Figure 6: Chilled Water Pump Tank Configuration Screen



Only pumps that are included in the system will be shown on this screen. Pumps will display one of the following states:

1. **OFFLINE** – This indicates that the pump has been turned off in the pump enable/disable screen. The pump will not be called to operate until it has been re-enabled. The color code for this indication is red.

2. **READY** – Indicates that the pump is enabled and ready to run. However, the current number of pumps specified to run does not require this pump to operate. The color code for this indication is yellow.

3. **ON LINE** – Pump is currently running. The color code for this indication is green.
4. **FAULT** – A safety on the pump indicates a fault condition and the pump has been deactivated. Once the problem is remedied, the pump will return to a READY state unless it is put in the OFFLINE state. The color code for this indication is **red**.

Viewing Active Alarms and Alarm History Screens

These two screens let you view any active alarm conditions as well as the alarm history for the entire history. The list of system alarms that are tracked are as follows:

- Chilled Water High Temperature Alarm
- Chilled Water Low Temperature Alarm
- Compressor Motor Protector Fault (One for each compressor)
- Chilled Water Circuit Low Flow (One per chilled water circuit)
- Chilled Water Circuit Freezestat (One per chilled water circuit)
- Chilled Water Circuit High Pressure (One per chilled water circuit)
- Chilled Water Circuit Low Pressure (One per chilled water circuit)
- Pump motor overload (One per system pump)

If an alarm condition occurs the follow screen is displayed:

Figure 7: Alarm Condition Screen

To acknowledge the alarm, press the alarm silence button to clear it. It will then appear in the alarm history screen. Except for High and Low Water Temperature, and Low Refrigerant Pressure, these alarms are considered fatal and maintenance must be preformed in order to allow the chiller to fully run. Should a compressor or pump turn off from an alarm condition the remaining will shut down and display **FAULT** in the status screen for the device.

If a fault occurs, that compressor or circuit is deactivated. The load will automatically shift to any other compressors that are currently ON-LINE, but not running. Lead/Lag rotation will continue to function. Compressors that are faulted will be removed from the rotation order.

Once a device has gone offline you will need to contact a licensed professional (electrician or refrigeration sevice company) to bring the device back online.

Caution! ***Never attempt to service a unit until a qualified electrician has opened and locked out the main disconnect using OSHA 1910.147 Standards.***

WARNING! ***Disconnect all power to the unit, let the unit cool down, and turn off the water prior to any servicing.***

Failure to do so can result in SERIOUS INJURY or DEATH!

Configuration Menu Screen

This screen allows the operator to configure the settings for the compressors, pumps, chiller setpoint, and high and low temperature alarm setpoints.

Operating the chiller compressors

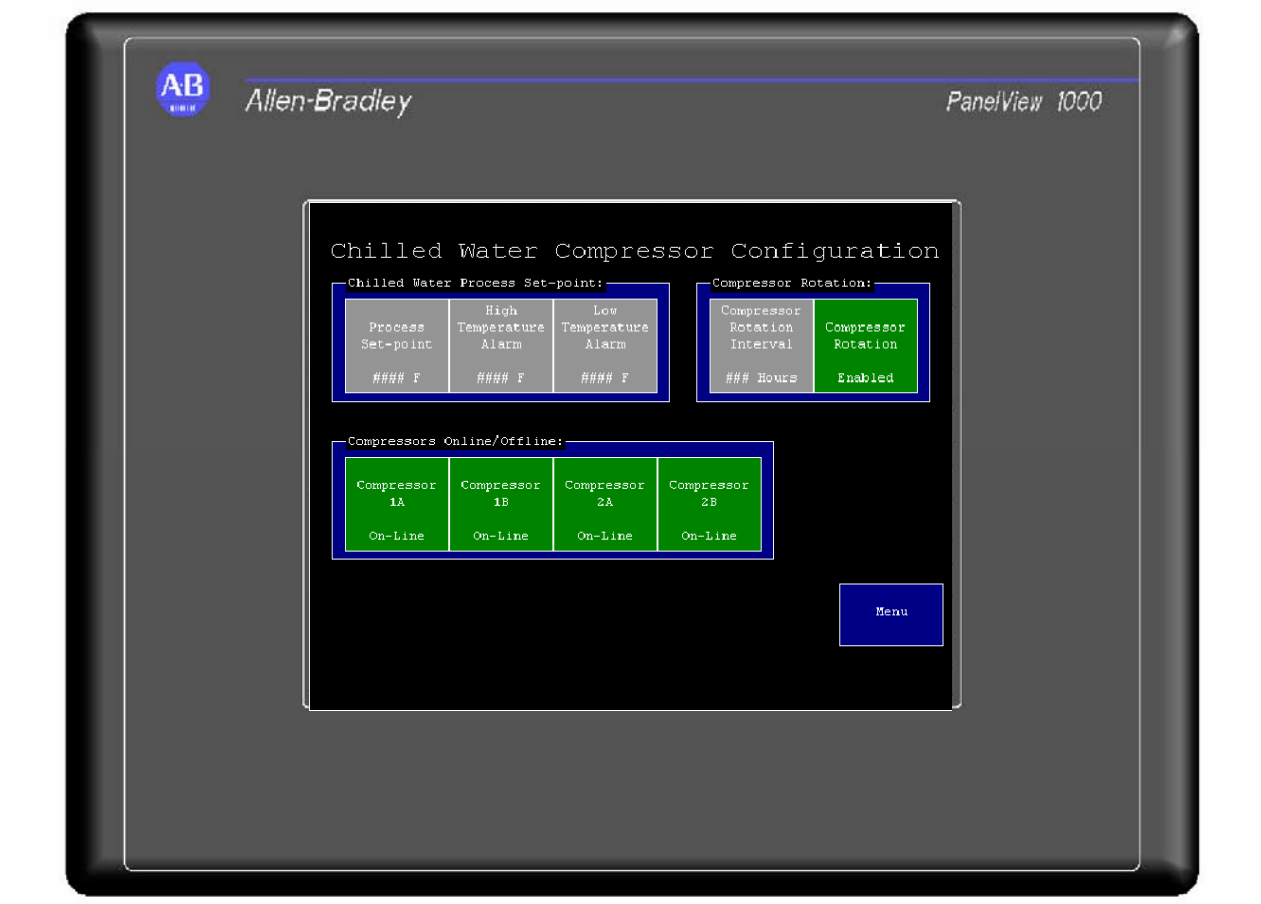
To enable or disable the individual compressors, start at the Main Menu, then:

1. Press the Up or Down buttons on the right side of the screen to highlight "**Chiller Configuration**"

2. Press the ↵ button

The configuration menu screen displays:

Figure 8: Chiller Configuration Screen



3. Touch the screen corresponding with the compressor you want to bring On-Line or Off-Line. The background color of the square turns green for On-Line and red for Off-line.

Operating Chiller Pumps

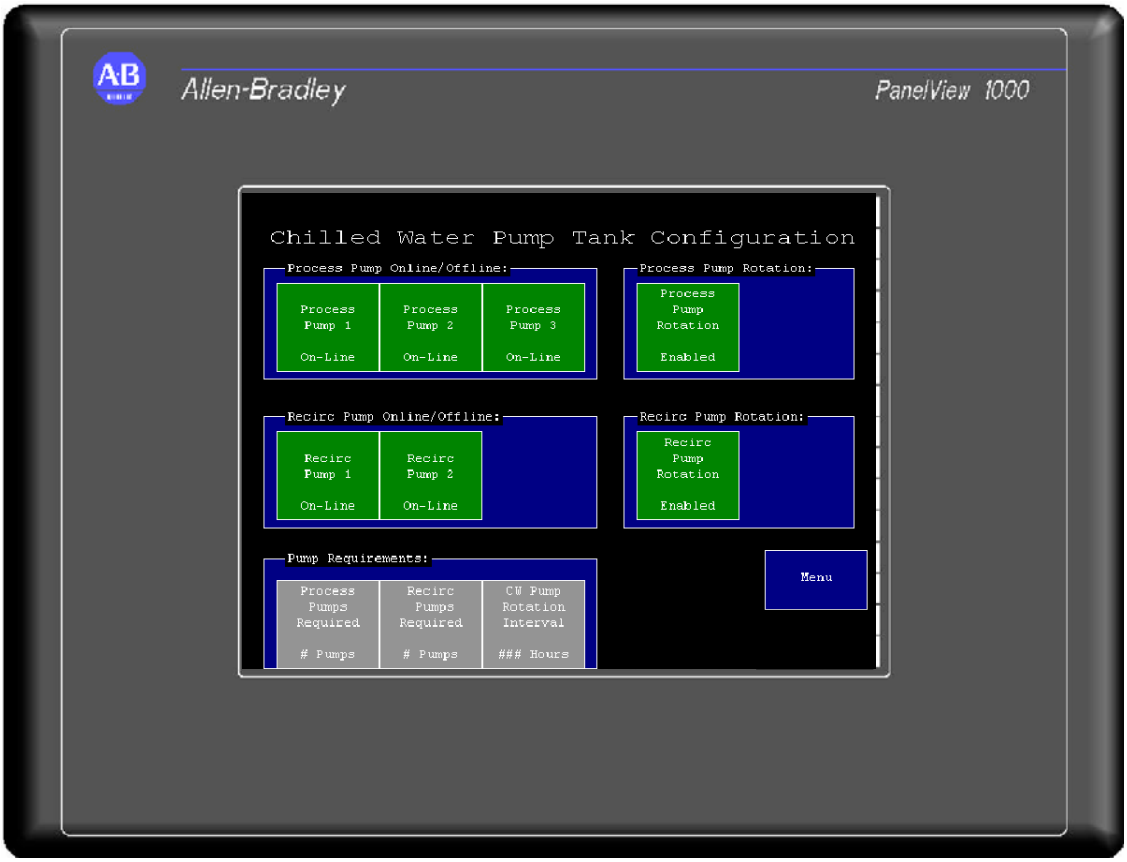
To turn on and off the pumps, start from the Main Menu, then:

1. Press the Up or Down buttons to highlight either "**Chilled Water Pump Tank Configuration**".

2. Press ↵

The Pump Enables Screen appears

Figure 9: Chilled Water Pump Tank Configuration Screen



Any pump that is disabled to the OFF-LINE position will not be called to operate. Simply press the button of the desired pump to toggle the state of the pump from the ON-LINE to OFF-LINE state.

Setting Compressor Rotation Times and Activating Compressor Rotation Operation

The system automatically rotates the compressor order to generate a Lead/Lag rotation. Any time a compressor is faulted or manually taken OFF-LINE, it will be removed from the Lead/Lag rotation. Once the fault is cleared or manually put ON-LINE, the compressor is returned to the Lead/Lag rotation at the end of the rotation order.

While in the Configuration Menu, the compressors can be setup in a rotation configuration using interval hours. By pressing the "**Compressor Rotation Interval**" button, a numeric keypad will be displayed and allow the user to change the timeframe of the interval (Maximum 400 minutes to 40 hours).

To activate the rotation operation touch the "**Compressor Rotation**" button. The status of the button will change to Enabled (green background), or Disabled (red background).

Setting Pump Rotation Times and Activating Pump Rotation Operation

The system automatically rotates the pump order to generate a Lead/Lag rotation. Any time a pump is faulted or manually taken OFF-LINE, it will be removed from the Lead/Lag rotation. Once the fault is cleared or manually put ON-LINE, the pump is returned to the Lead/Lag rotation at the end of the rotation order.

While in the Chilled Water Pump Tank Configuration Menu, the pump lead/lag (rotation) can be enabled or disabled. Simply press the Process or Recirculation Pump Interval button on the screen to toggle between Enabled and Disabled.

The interval between rotating pumps may also be setup in this screen. Press the CW Pump Rotation Interval button to bring up the time entry screen. Acceptable range is 50-200 hours.

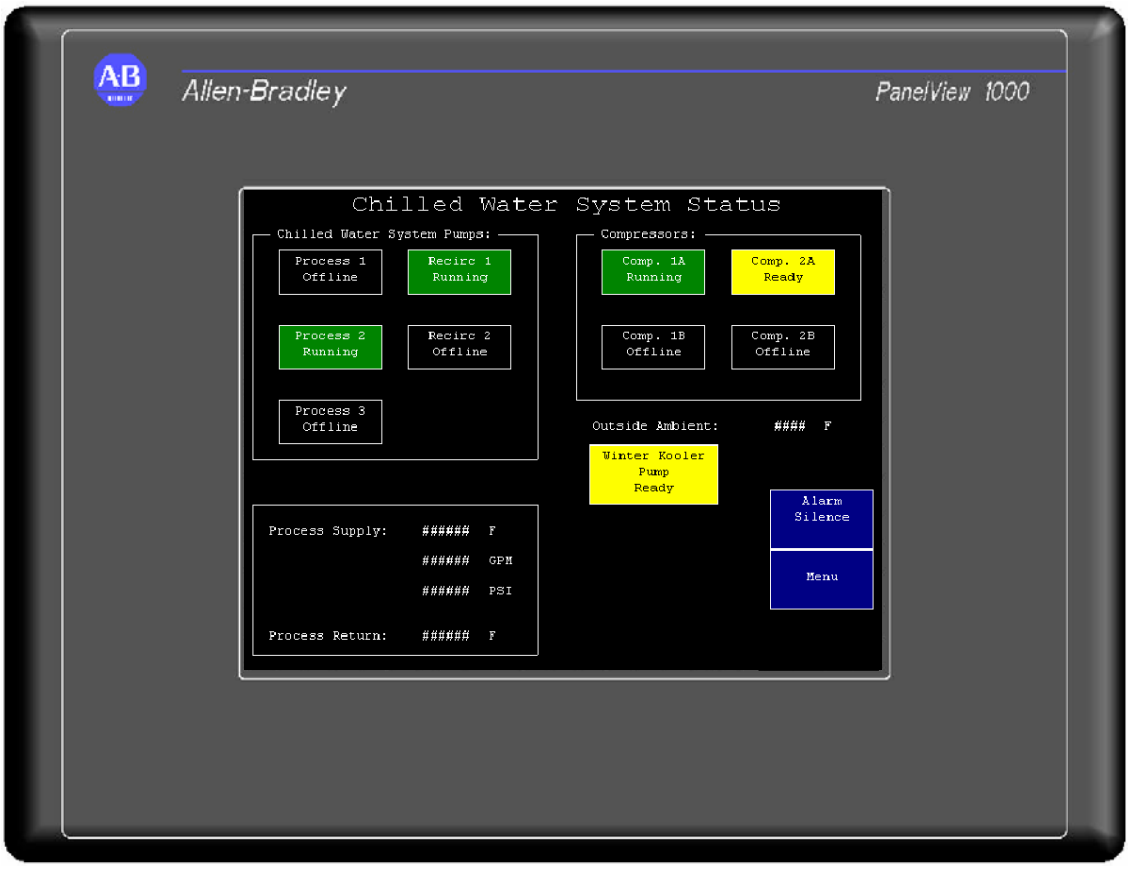
Viewing and Setting System Temperatures

To view the actual process temperature start at the Main Menu and

1. Use the Up or Down arrows to highlight "**Chilled Water System Status**"
2. Press ↵

The system status displays:

Figure 10: Chilled Water System Status Screen



Note: If you have a metric version of the controller, the screens display in converted metric values.

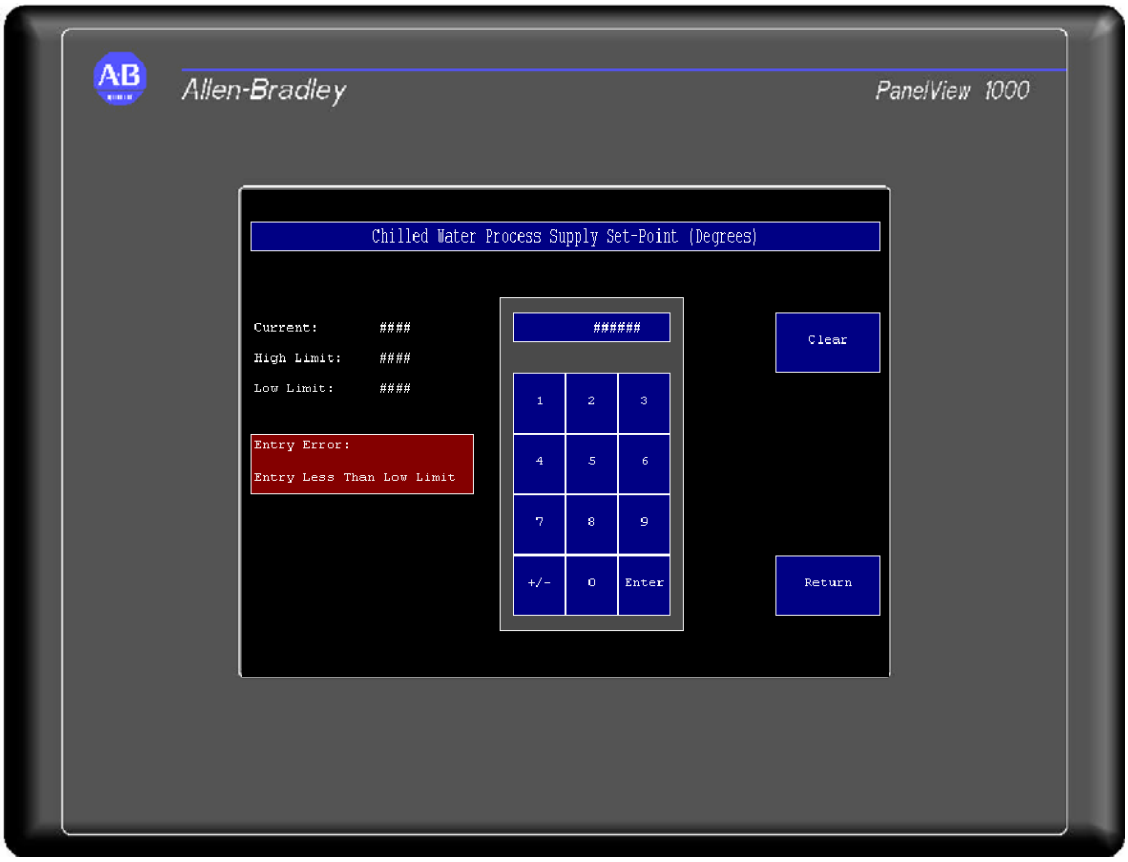
Setting System Temperatures

The chiller setpoints are set through the chiller configuration menu. Starting from the Main Menu:

1. Press the Up or Down buttons to highlight "**Chiller Configuration**"
2. Press ↵
3. Touch the "Process Set-point" button

The input display screen appears:

Figure 11: Temperature Input Display Screen



4. Press the "Enter" key on the keypad and press the "Return" button to return to the Chiller Configuration screen.

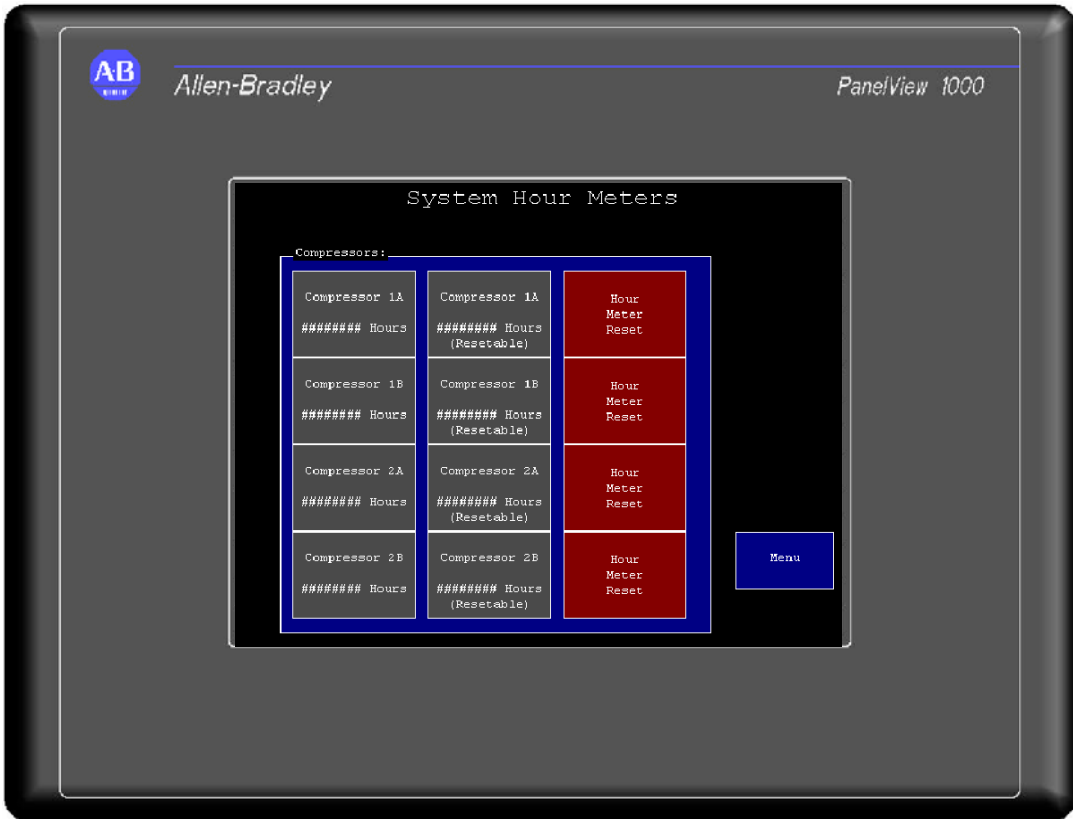
Viewing Compressor Run Times

From the Main Menu, use the Up or Down buttons to highlight the "**Compressor Hourmeters**" menu. Then press ↵ to display the hourmeters.

Note: ***this is a complete list of all compressors that may be included in the system. Any compressor that is not included in the system will not accumulate time.***

The Compressor Run Time screen displays:

Figure 8: Compressor Run Time Display Screen



Two hourmeters are kept for each compressor in the system. The first is a lifetime meter. This measures the total time that the compressor has been operational in the lifetime of the chiller. The second is a resettable hourmeter. This hourmeter can be cleared to monitor run time on specific intervals. In order to clear the resettable hourmeter, press the **Hour Meter Reset** button (as prompted on the screen).

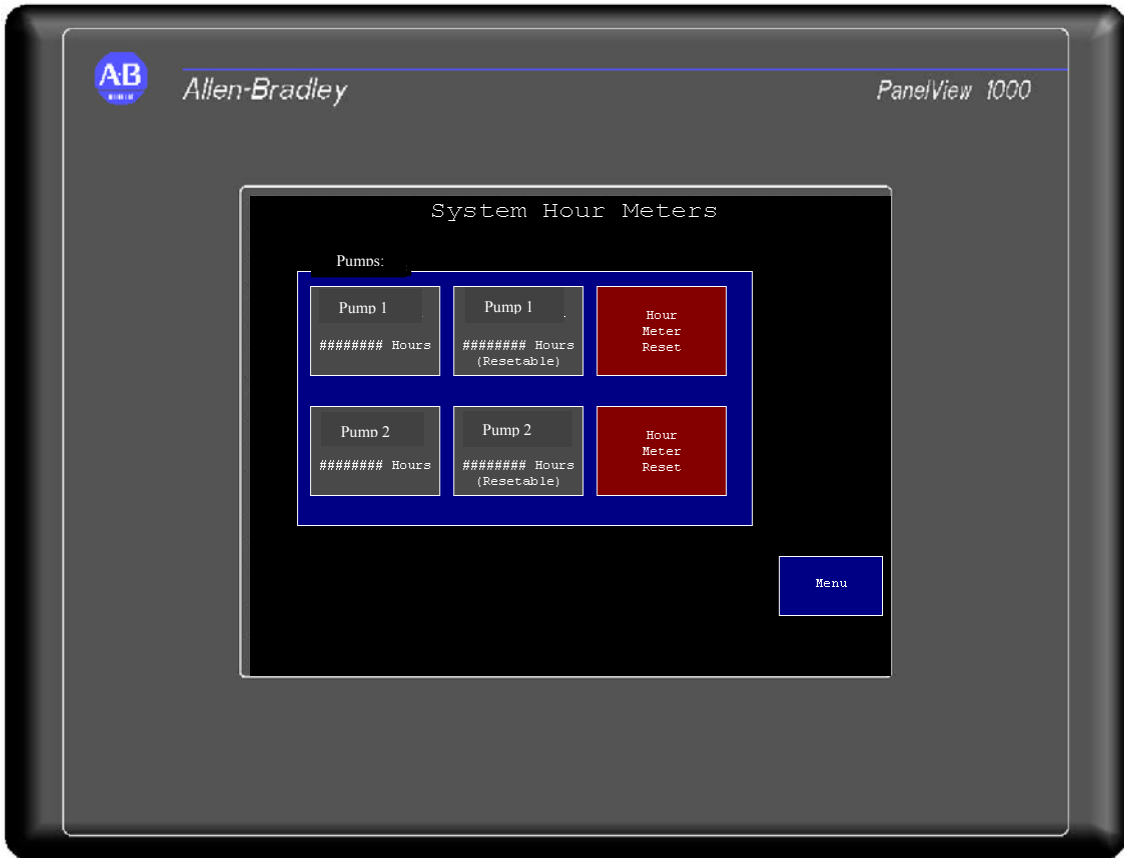
Viewing Pump Run Times

From the Main Menu, use the Up or Down buttons to highlight either the "**Chilled Water Process Pump Hourmeters**" or "**Chilled Water Recirc Pump Hourmeters**" menu. Then press ↵ to display the hourmeters.

> ***Note:*** ***this is a complete list of all pumps that may be included in the system. Any pump that is not included in the system will not accumulate time.***

The Pump Run Time screen displays:

Figure 9: Pump Run Time Display Screen



Two hourmeters are kept for each compressor in the system. The first is a lifetime meter. This measures the total time that the pump has been operational in the lifetime of the chiller. The second is a resettable hourmeter. This hourmeter can be cleared to monitor run time on specific intervals. In order to clear the resettable hourmeter, press the appropriate "**Hour Meter Reset**" button (as prompted on the screen).

4-5 Operation Procedures

Standard Controller

1.

Advanced Controller

4-6 Shutdown

1. Ready process and related equipment for shut down.
2. Do not turn off the main power until chiller completes the shutdown sequence (approximately 2 minutes).
3. Close the water make up valve.
4. If the system is to be drained, open the 2” drain valve.

Chapter 5: Maintenance

5-1 Maintenance Schedule

The checklist below contains a list of items which should be inspected and/or replaced to keep your Central Chiller operating at peak efficiency. Perform each inspection at the regular intervals listed below.

System model #	Serial #

Every week	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By	Date/ By

Every month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Every year	Next scheduled inspection	Actual inspection Date/By	Next scheduled inspection	Actual inspection Date/By

Every two years	Scheduled replacement date	Actual replacement Date/Work done by	Scheduled replacement date	Actual replacement Date/Work done by

- Photocopy this page for your maintenance records -

5-2 Preventative Maintenance

A systematic preventive maintenance program helps avoid costly down time. It is recommened that this service be performed on an annual basis to keep equipment operating at peak efficiency. Call the Service Department to arrange a schedule of inspections.

Inspections include:

1. Checking refrigerant suction and discharge pressures.
2. Checking safety and operating controls.
3. Checking voltage and amperage of all motors.
4. Checking all electrical connections.
5. Checking quantity of refrigerant.
6. Checking compressor oil level.
7. Annual oil sample analysis.
8. Checking lubrication of motor and pump bearings.
9. Checking circulating pump operation.
10. Checking flow through heat exchangers.
11. Checking compressor efficiency.
12. Checking noise levels.
13. Checking cleanliness of equipment area.

Although the manufacturer does not recommend that you perform these maintenance procedures on your own, the two items listed below (performed on a regular basis) will increase the longevity and efficiency of your unit. It is recommended that you contact the manufacturer to have any maintenance performed on this equipment.

Lubrication

Grease all fan bearings, fan motors, and pump motors that do not have permanently sealed bearings. Remove the grease relief plug (motors only) before adding grease. **Failure to do so may dislodge the bearing grease retainer which will eventually cause bearing failure**.

Lubricate components regularly, based only on the component manufacturer's specifications for frequency and lubricant.

Screw compressors require a special oil (Solest 170); failure to use this oil when lubricating will *void the warranty.*

Condenser Maintenance

Dirty condenser heat exchange surfaces reduce system capacity. Inspect and clean as needed.

Remote Air-Cooled

Brush or vacuum light dirt accumulations. Avoid bending or damaging the fins. Heavy soil accumulations on the coil require professional steam cleaning or pressure washing by a qualified refrigeration service technician. Washing from the outside will only make matters worse.

Water-Cooled

Proper water treatment will greatly reduce cleaning intervals.

Remove dirt in the condenser tubes with a nylon tube brush. Mineral deposits can be removed by circulating Liquid De-Scaling Solution (Model Number A0502600) through the water side of the condenser. Follow the directions on the container.

The refrigerant side is sealed and requires no routine maintenance.

5-3 Corrective Maintenance

Evaporator Maintenance

The evaporator(s) may be accessed for back-flushing by removal of the 1 1/2" plug (approx. 51 mm) in the return control nipple and the flow switch in the supply control nipple. If the suggested piping recommendations have been followed, one circuit of a multiple circuit chiller may be back-flushed without shutting down the entire system. Check Y-strainer for any clogging.

Miscellaneous Maintenance

The compressor oil sample should be analyzed at least once a year to monitor wear and any possible contamination.

Caution! ***Sample must be taken by qualified refrigeration service technician.***

Chapter 6: Troubleshooting

6-1 Introduction

The utmost in safety precautions should be observed at all times when working on or around the machine and the electrical components. All normal trouble-shooting must be accomplished with the power off, line fuses removed, and with the machine tagged as out of service.

The use of good quality test equipment cannot be over-emphasized when troubleshooting is indicated. Use a good ammeter that can measure at least twice the AC and DC current that can be encountered for the machine. Be sure that the voltmeter has at least minimum impedance of 5,000 OHMS-per-volt on AC and 20,000 OHMS-per-volt on DC scales. Popular combination meters, VOM and VTVM can be selected to provide the necessary functions.

Before making haphazard substitutions and repairs when defective electrical components are malfunctioning, we recommend that you check the associated circuitry and assemblies for other defective devices. It is common to replace the obviously damaged component without actually locating the real cause of the trouble. Such hasty substitutions will only destroy the new component. Refer to wiring diagrams and schematics.

Locating mechanical problems, should they occur, is relatively straightforward. When necessary, refer to the parts catalog section.

Problem	Possible cause	Corrective action
Unit does not run.	No power.	Check main disconnect, fuses, wiring, and power lead to unit.
	Wrong voltage supplied to unit.	Voltage must be within plus or minus ten percent (±10%) of nameplate rating.
	Defective On/Off switch.	Replace switch.
	Control circuit fuse blown.	Replace fuse, check transformer, check wiring for loose wires, check for shorted coils on contactors and solenoids, check crankcase heater.
	Defective control transformer.	Replace.
	Unit is off on flow switch (Flow alarm Present).	Check that the chiller pump is running.
		Check that all valves are open.
		Check for defective flow switch.

Problem	Possible cause	Corrective action
Compressor does not run. Check active alarm screen.	Freeze control set higher than temperature of liquid in system. (Freezestat alarm)	Lower freeze control setting to 10°F (6ºC) below the leaving temperature you want.
	High pressure refrigerant cutout switch contacts open.	*Remote Air cooled units:* Check condenser fans for proper rotation. Check for dirty condenser. Check for condenser air obstruction. Check for blown fuses or bad condenser fan motor.
		Water cooled units: Check for water valves turned on. Check for dirty condenser. Check water flow through condenser.
	Compressor internal overload open. (Alarm)	Allow time to cool and reset. Check for high/low voltage. Voltage must be within plus or minus ten percent (±10%) of nameplate rating.
		Check for poor compressor electrical connections.
	Compressor contactor holding coil open.	Repair or replace.
	Low refrigerant pressure switch contact open. (Low pressure alarm)	
	Defective pump motor interlock to PLC.	Repair or replace.
	Broken wire in the compressor control circuit.	Locate and repair.
Pump runs, compressor cycles at two minute intervals. Check alarm screen.	Freezestat control setting is too high. (Freezestat alarm)	Lower set point to 10°F (6ºC) below the leaving water temperature you want with at least 15 degrees differential.
	Refrigerant is too low.	Check refrigeration charge; check refrigerant sight glass for bubbles or a level in the glass.
Leaving water temperature is not at set point.	Improper water/glycol mixture.	Be sure the antifreeze mixture protection is right for the process.
	Defective freezestat control.	Replace.
	Refrigerant charge is low.	Call service to find and repair the leak. Add refrigerant.

Problem	Possible cause	Corrective action
Unit runs continuously, but not enough cooling power.	Restricted condenser air flow.	Clean condenser.
	Refrigerant not feeding.	Check superheat on expansion valve.
	Improper water/glycol solution.	Make sure that coolant mixture protection is right for the process.
	Poor heat transfer in evaporator.	Backflush and clean evaporator.
	Unit low on refrigerant.	Call service.
	Low water flow through evaporator.	Increase flow to design flow of 2.4 gpm/ton.
	Inefficient compressor.	Call service.
	Unit under-sized for application.	Call sales representative.

Chapter 7: Appendix

7-1 Optional Components

The following is a list of options which your Screw Compressor Central Chiller may have been equipped with:

- Advanced control package including: AB SLC 5/04 PLC with PanelView 1000 color touch screen, control of up to nine additional chillers, cooling tower system, water treatment system, and DH+ communication capabilities
- General Fault audible/visual alarm with elevated light stack
- Non-fused rotary thru-the-door disconnect switches
- Electrical operation available in 208, 460, and 575 volts, 60 Hz; 200, 380, and 415 volts, 50 Hz
- UL/$_C$UL-listed electrical subpanel
- Water cooled condenser manifold
- Onsite startup

7-2 Technical Specifications

Model Number Nomeclature

RS W 060

RS – Screw Compressor Central Chiller

Condenser Type
R – Remote Air Cooled
W – Water Cooled

Nominal Unit Size – Tons (kW)

060 – 60 (211.0)	115 – 115 (404.4)
075 – 75 (263.8)	145 – 145 (509.9)
090 – 90 (316.5)	165 – 165 (580.3)
100 – 100 (351.6)	195 – 195 (685.8)

Typical Two-Circuit 60-195 Ton Remote Water Cooled Chiller Specifications

Model		RSW-xxx			
		60	**75**	**90**	**100**
Cooling Capacity (tons) @ 50°F LWT①		60.4	74.9	88.8	102.2
Capacity stages		Infinite Unloading			
EER (BTUH/W)		15.2	15.1	15.7	15.5
Nominal water flow (gpm)	Evaporator②	145	180	213	245
	Condensers③	181	225	266	307
Condenser connection (no manifold) Flange Conn. (in.)		2.5		3	
Evaporator manifold connection Victaulic		3		4	
Amp draw, nameplate (460/3/60 V)④	Water-cooled	112	130	138	170
Dimensions (in.)	Height	85		77	
	Width	100		115	
	Depth	45		72	
Shipping weight (lbs.)		3,266	3,512	4,336	4,982
Max operating weight (lbs.)		3,468	3,754	4,594	5,246

① Based on 50ºF (10ºC) chilled water supply temperature and 85ºF (29ºC) tower water.
② Based on 2.4 gpm per ton (9.1 lpm per 3.517 kW), 2.9 gpm/ton (11 lpm per 3.517 kW) for glycol/water mixes.
③ Based on availability of 85ºF (*29ºC*) tower water at 25 psi (*172.4 kPa/1.7 bars*) minimum. 3 gpm/ton.
④ Multiply 460/3/60 amperage by 2.0 for 208-230/3/60 amperages; multiply by 1.2 for 380/3/60 amperages; multiply by 0.8 for 575/3/60 amperages

Model		RSW-xxx			
		115	**145**	**165**	**195**
Cooling Capacity (tons) @ 50°F LWT①		116.3	146.0	166.3	193.1
Capacity stages		Infinite Unloading			
EER (BTUH/W)		15.5	16.2	15.9	16.2
Nominal water flow (gpm)	Evaporator②	279	350	399	463
	Condensers③	349	438	499	579
Condenser connection (no manifold) Flange Conn. (in.)		3	4		
Evaporator manifold connection Victaulic		4	6		
Amp draw, nameplate (460/3/60 V)④	Water-cooled	216	250	282	316
Dimensions (in.)	Height	77	81		
	Width	115	130		
	Depth	72	76		
Shipping weight (lbs)		5,298	8,844	9,376	9,580
Max operating weight (lbs.)		5,584	9,428	10,102	10,364

① Based on 50ºF (10ºC) chilled water supply temperature and 85ºF (29ºC) tower water.
② Based on 2.4 gpm per ton (9.1 lpm per 3.517 kW), 2.9 gpm/ton (11 lpm per 3.517 kW) for glycol/water mixes.
③ Based on availability of 85ºF (*29ºC*) tower water at 25 psi (*172.4 kPa/1.7 bars*) minimum. 3 gpm/ton.
④ Multiply 460/3/60 amperage by 2.0 for 208-230/3/60 amperages; multiply by 1.2 for 380/3/60 amperages; multiply by 0.8 for 575/3/60 amperages

Typical Two-Circuit 60-195 Ton Remote Air Cooled Chiller Specifications

Model		RSR-xxx			
		60	**75**	**90**	**100**
Cooling Capacity (tons) @ 50°F LWT		53.8	67.1	79.1	91.2
Capacity stages		Unloading			
EER (BTUH/W)		9.4	9.9	9.8	10
Nominal water flow (gpm)	Evaporator	129	161	190	219
Evaporator manifold connection Victaulic		3		4	
No. of condenser fans per condenser		3	3	4	4
Amp draw, nameplate (460/3/60 V)	Chiller	112	130	138	170
	Condensers (per condenser)	11	11	14	14
Dimensions (in.) of chiller	Height	75		74	
	Width	100		115	
	Depth	46		72	
Dimensions (in.) of each condenser	Height	50			
	Width	45.5		45.5	
	Depth	125	180	180	235
Shipping weight (lbs.)	Chiller	2,574	2,676	3,456	3,532
	Condensers (each condenser)	880	1,210	1,240	1,620
Max operating weight (lbs.)	Chiller	2,600	2,710	3,498	3,580
	Condensers	1,000	1,235	1,670	1,650

Model		RSR-xxx			
		115	**145**	**165**	**195**
Cooling Capacity (tons) @ 50°F LWT		104.1	130.5	148.4	174.0
Capacity stages		Unloading			
EER (BTUH/W)		10.3	10.5	10.4	10.2
Nominal water flow (gpm)	Evaporator	250	313	356	418
Evaporator manifold connection Victaulic		4	6		
No. of condenser fans per condenser		4	5	6	8
Amp draw, nameplate (460/3/60 V)	Chiller	216	250	282	316
	Condensers (per condenser)	14	18	21	28
Dimensions (in.) of chiller	Height	77	81		
	Width	115	127		
	Depth	72	75		
Dimensions (in.) of each condenser	Height	50			
	Width	45.5			88
	Depth	235	290	345	235
Shipping weight (lbs.)	Chiller	4,156	7,528	7,554	7,698
	Condensers (each condenser)	1,760	2,200	2,390	3,230
Max operating weight (lbs.)	Chiller	4,212	7,788	7,814	8,016
	Condensers (each condenser)	1,800	2,245	2,440	3,290

① Based on 50ºF (10ºC) chilled water supply temperature and 95ºF (35ºC) ambient air.

② Based on 2.4 gpm per ton (9.1 lpm per 3.517 kW). 2.9 gpm/ton (11 lpm per 3.517 kW) for glycol/water mixes.

③ Multiply 460/3/60 amperage by 2.0 for 208-230/3/60 amperages; multiply by 1.2 for 380/3/60 amperages; multiply by 0.8 for 575/3/60 amperages

RSR Series Remote Condenser Models

Model Number	Fan(s) Each Dia. In.	Motor hp ①	Amps 460V	Fans	Air flow cfm ③	Refrigeration ② Connections Discharge ODS(in.)	Liquid ODS(in.)	Charge R-134a lbs. ②
RSR60	30	1 ½ hp ø	7.0	2	20,700	2 1/8	2 1/8	19
RSR75	30	1 ½ hp 3 ø	10.5	3	32,900	2 1/8	2 1/8	24
RSR90	30	1 ½ hp 3 ø	10.5	3	31,800	2 1/8	2 1/8	29
RSR100	30	1 ½ hp 3 ø	14.0	4	43,900	2 1/8	2 1/8	29
RSR115	30	1 ½ hp 3 ø	14.0	4	41,500	2 1/8	2 1/8	36
RSR145	30	1 ½ hp 3 ø	17.5	5	51,800	2 5/8	2 5/8	43
RSR165	30	1 ½ hp 3 ø	21.0	6	65,800	2 5/8	2 5/8	50
RSR195	30	1 ½ hp 3 ø	21.0	8	87,800	2 @ 2 5/8	2 @ 2 5/8	58

① ø represents electrical phase; all motors are 1,140 rpm. Multiply hp by **0.746** to convert to *kW*.

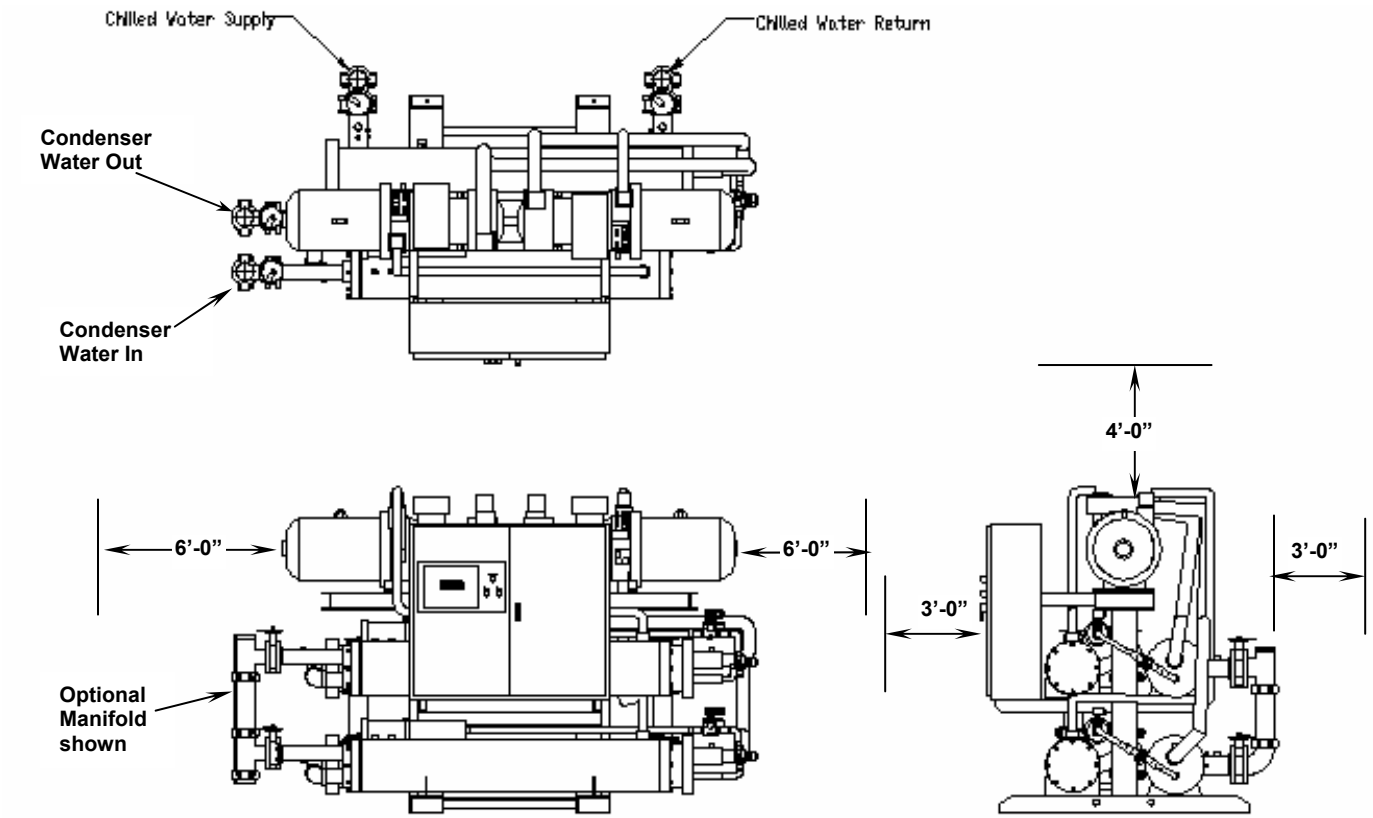
② Refrigeration charge is for **remote condenser only!** Additional refrigerant is requied for lines and chiller.

③ To convert cfm to *cmh*, multiply by **1.699**. To convert lbs. to *Kg*, multiply by **0.454.**

7-3 Drawings & Diagrams

Figure 10: Typical Two-Circuit 60-195 Ton Water Cooled Chiller

Minimum required service clearance



7-4 Spare Parts List

Part No.	Part Description	Quantity

Check your Customer Information Packet for a complete list of spare parts and part numbers for your central chilling station.

7-5 Returned Material Policy

Credit Returns

Prior to the return of any material **authorization** must be given by **the manufacturer.** A RMA number will be assigned for the equipment to be returned.

Reason for requesting the return must be given.

ALL returned material purchased from **the manufacturer** returned is subject to 15% ($75.00 minimum) restocking charge.

ALL returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

No credit will be issued for material that is not within the manufacturer's warranty period and/or in new and unused condition, suitable for resale.

Warranty Returns

Prior to the return of any material, authorization must be given by **the manufacturer.** A RMA number will be assigned for the equipment to be returned.

Reason for requesting the return must be given.

All returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

After inspecting the material, a replacement or credit will be given, at **the manufacturer's** discretion. If the item is found to be defective in materials or workmanship, and it was manufactured by our company**,** purchased components are covered under their specific warranty terms.

7-6 Safety Tag Information

Central Chiller Safety Tags

Hot!

Operation
tion

High Voltage

h Ground

Inside Enclosure

Lifting Point

PE Protected Earth Ground

7-7 Central Chiller Identification (Serial Number) Tag

(Located on back of Chiller)

Company Logo

CE *XXX-XX Series Central Chiller*
Model Number XXX-30
Max Capacity HR

460V **Serial Number 060701R**
Date of Manufacture Month/Year

Over-current Protection Device (s) Total
Frequency 50/60Hz

Street Address **City, State Zip Code**
Telephone Number

7-8 Technical Assistance

Parts Department

Call toll-free 7am–5pm CST [800] 423-3183 or call [847] 273-7700, Fax [847] 273-7804
The ACS Customer Service Group will provide your company with genuine OEM quality parts manufactured to engineering design specifications, which will maximize your equipment's performance and efficiency. To assist in expediting your phone or fax order, please have the model and serial number of your unit when you contact us. A customer replacement parts list is included in this manual for your convenience. ACS welcomes inquiries on all your parts needs and is dedicated to providing excellent customer service.

Service Department

Call toll-free 8am–5pm CST [800] 423-3183 or call [847] 273-7700
Emergencies after 5pm CST, call [847] 273-7700
We have a qualified service department ready to help. Service contracts are available for most products. www.acscustomerservice.com

Sales Department

Call [847] 273-7700 Monday–Friday, 8am–5pm CST
Our products are sold by a world-wide network of independent sales representatives. Contact our Sales Department for the name of the sales representative nearest you.

Contract Department

Call [847] 273-7700 Monday–Friday, 8am–5pm CST
Let us install your system. The Contract Department offers any or all of these services: project planning; system packages including drawings; equipment, labor, and construction materials; and union or non-union installations.